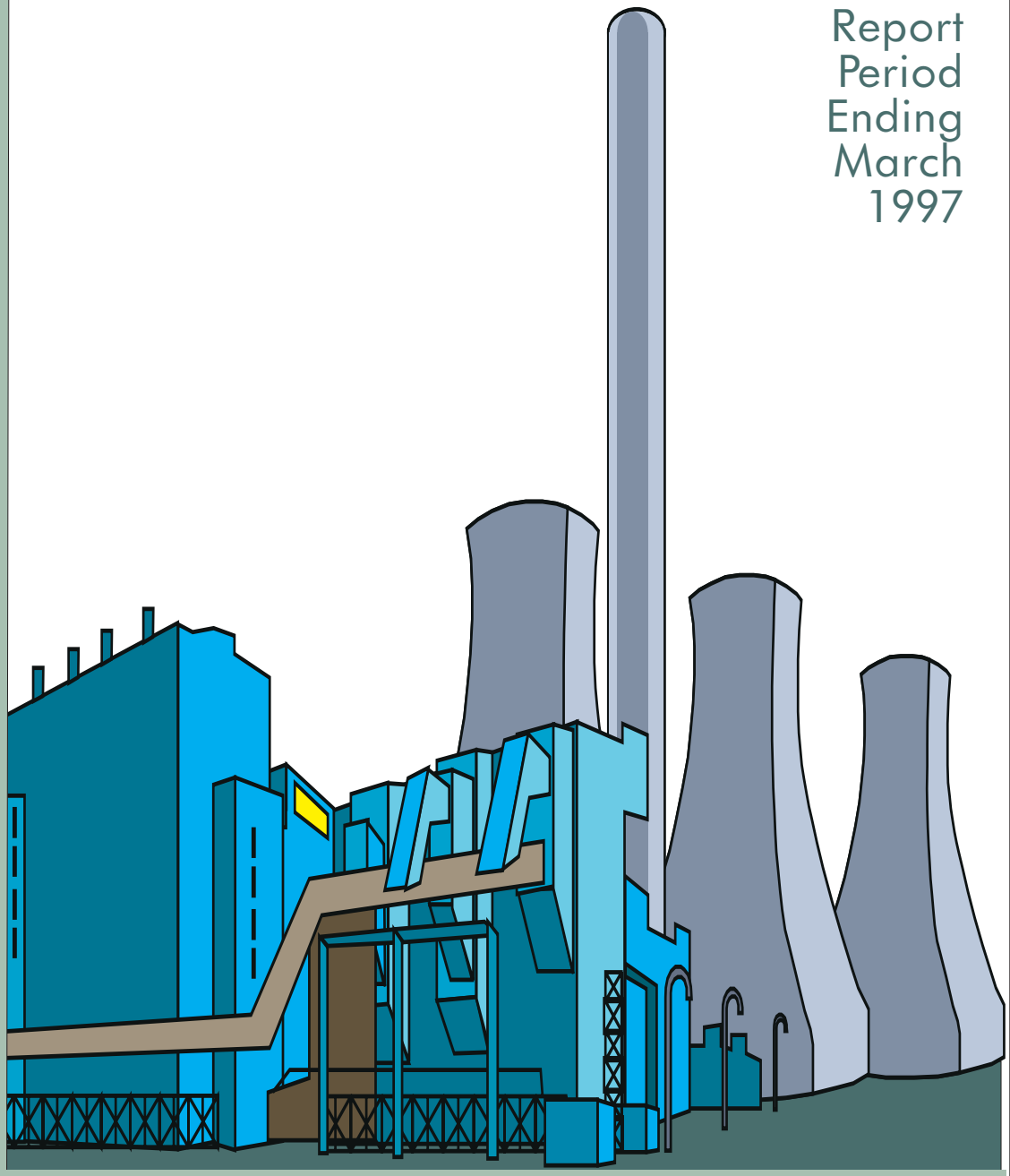
DOE/EH-0531(1Q97)

# Performance Indicators for ES&H

Report Period Ending March 1997

ES&H

Office of Environment, Safety and Health



DOE Operating Experience Analysis

*Safety Management Through Analysis*

October 1997

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# Introduction

**Vision**

DOE is well on its way to implementing performance-based management in all aspects of its operations. This report is intended both as a corporate level report on how we are doing in ES&H, as well as a stimulus to encourage further fact-based analysis.

**Data Availability**

Three performance indicators and their accompanying analysis in this report are unchanged from the previous report due to the inability to get updated information. These include Environmental Permit Exceedances (PI-8), Radiation Dose to the Public (PI-10), and Worker Radiation Dose (PI-11). In some cases, the fix to this lack of information is to provide more automation — an option that may even reduce data collection/handling costs due to advances in information management technology. This is especially true where data collection is done by paper reports. In other cases, the fix may be to establish new processes to collect and forward the data — an area that must be approached cautiously to ensure cost-effectiveness. We are continuing to pursue these.

**New Indicators**

We have long recognized that the suite of performance indicators in this report is not complete. For example, we have few measures in the area of ES&H management, although the recent Integrated Safety Management process should give birth to some measures in this area. New indicators presented in in this report include Price-Anderson Amendments Act Enforcement, Enhanced Work Planning Implementation, and Waste Generation. As we continue to improve our suite of corporate ES&H performance indicators, we welcome your input and ideas.

**Assessment**

- As noted in last quarter's report, lost workday case rate and OSH cost index continue to exhibit favorable trends (see PI-1 and PI-2). However, as cited by the Office of the Inspector General in IG Report IG-0404, *Audit of Department of Energy Contractor Occupational Injury and Illness Reporting Practices,* this improvement, in part, may be due to underreporting of OSH related information. This points out the need for clear and consistent OSH reporting throughout the complex.

- We are starting to see an increasing trend in both the number and the severity of industrial operations safety related events (see PI-4). The increase in severity is characterized by a fatality that occurred at the Oak Ridge K-25 site in February, where a maintenance worker died as a result of burns received while performing cutting/welding operations.

- Although the number of radiological events appears to be relatively stable since the first quarter of 1996 (see PI-12), there has been a significant increase in the number of internal contamination events noted this quarter (seven this quarter up from two last quarter).

- The number of safety equipment degradation events dropped significantly this quarter (see PI-16). This decrease is largely due to a decline in the number of ventilation system related degradations, more specifically at Rocky Flats.

- Only modest progress was made in stabilizing the remaining plutonium inventory throughout the complex this quarter. Of the remaining plutonium solution inventory, less than 2% was stabilized (see PI-21).

**On the Web**

This report and the additional analytical tools, techniques, and data can be found on our Internet web site. Please visit us at http:/tis.eh.doe.gov/web/oeaf.

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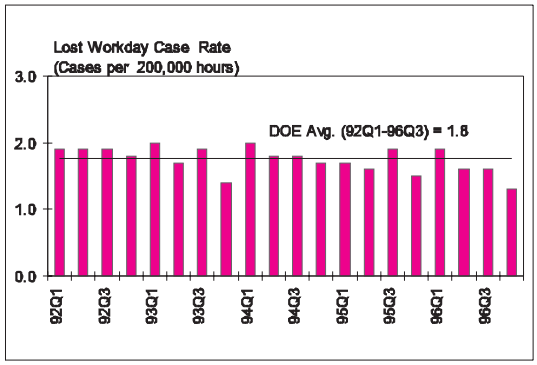
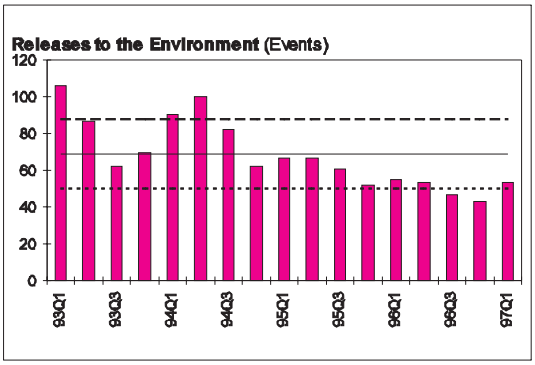
# Management Summary

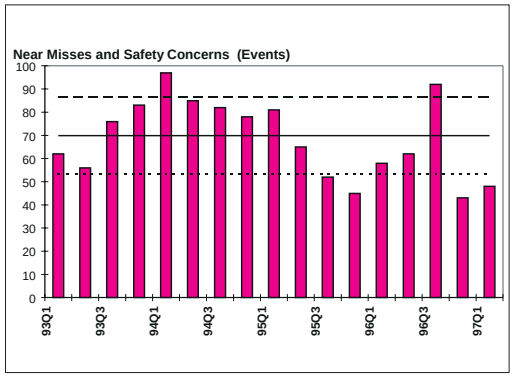
Six of the DOE Environment, Safety and Health Performance Indicators were selected this quarter to highlight below. Lost Workday Case Rate and Reportable Occurrences of Releases to the Environment are included in the Secretary of Energy's Key Indicators. The horizontal lines on the graphs represent the historical baseline ±1 standard deviation. Quarterly data is presented as calendar quarters. Trends are identified based on a statistical analysis of the data. A detailed discussion of the method [Multinomial Likelihood Ratio Test (MLRT)] is provided in the Glossary section of this report.



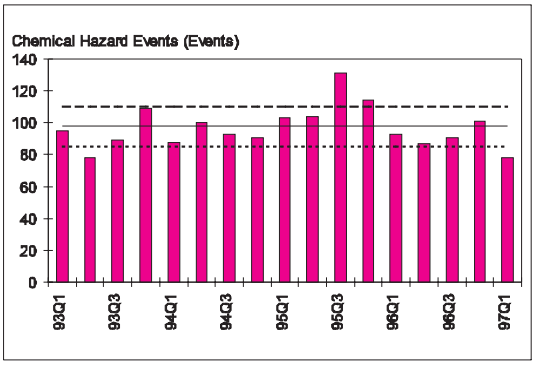

A lost workday case is a work-related injury or illness that involves days away from work or days of restricted work activity, or both. Lost Workday Case (LWC) Rate is the number of lost workday cases per 200,000 hours worked.



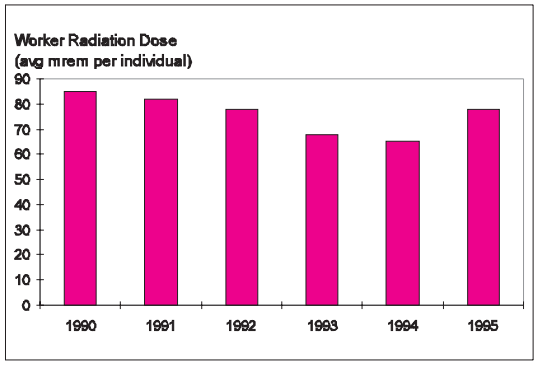

Number of releases of radionuclides or hazardous substances or regulated pollutants that are reportable to federal, state, or local agencies.



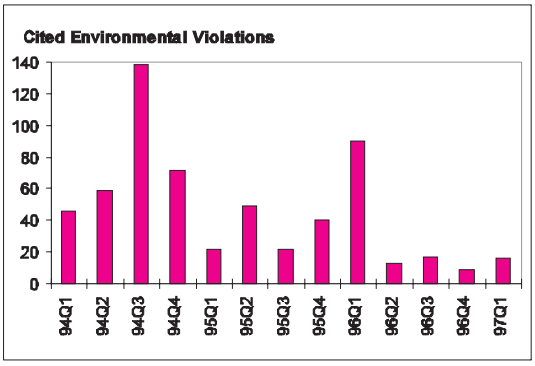

Number of events related to near misses or safety concerns reportable under DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information.*




Number of events reportable under DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*, that are gathered by a word search for specific chemical names.




The average measurable dose to DOE workers, determined by dividing the collective total effective dose equivalent (TEDE) by the number of individuals with measurable dose.




Number of environmental violations cited by regulators in enforcement actions at DOE facilities.

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# List of Performance Indicators

The performance indicators are organized into four major categories. The numbers correspond to the section numbers

## 1. Accidents/Events that have already happened

Injuries, fatalities, releases, uptakes, etc.

1. Lost Workday Case Rate
2. Occupational Safety and Health Cost Index
3. Electrical Safety
4. Industrial Operations Safety
5. Chemical Hazard Events
6. Reportable Occurrences of Releases to the Environment
7. Cited Environmental Violations
8. Environmental Permit Exceedances
9. Price-Anderson Amendments Act Enforcement [new]
10. Radiation Dose to the Public
11. Worker Radiation Dose
12. Radiological Events

## 2. Precursors to accidents and near misses

Events which resulted in significant reduction of barriers that are depended upon for safety.

13. Near Misses and Safety Concerns
14. Inadequate Procedures/Procedures Not Followed
15. Safety System Actuations
16. Safety Equipment Degradation

## 3. ES&H Management

Includes work planning, training, manager and worker involvement, and regulatory compliance.

17. Environmental Compliance Milestones Met
18. Open DNFSB Recommendations
19. Enhanced Work Planning Implementation [new]

## 4. Hazards level of material at risk

Working with the program offices and sites, we hope to show how DOE is reducing hazards and vulnerabilities.

20. Spent Nuclear Fuel and Plutonium Vulnerabilities Resolved
21. Plutonium Stabilization
22. Waste Generation [new]
23. HEU Vulnerabilities

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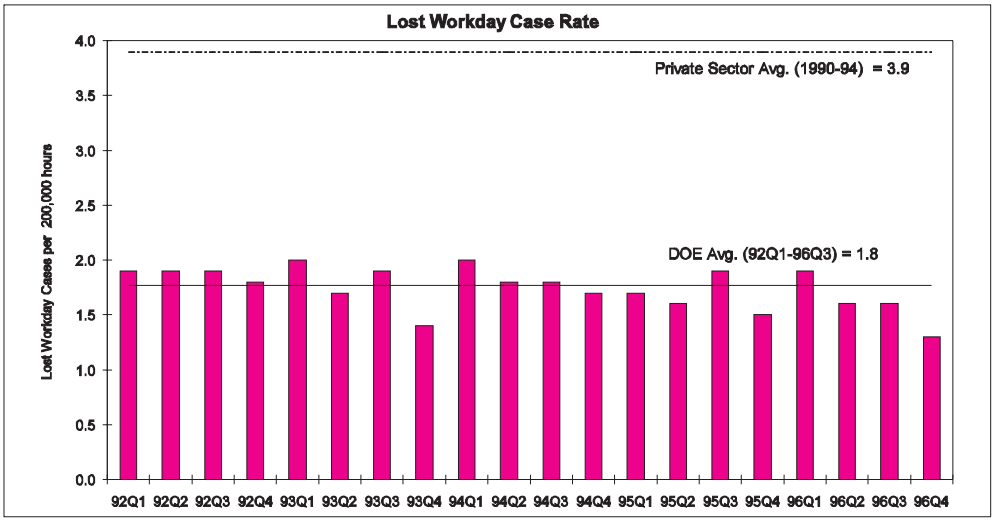
***Indicator***

# 1. Lost Workday Case Rate

***Definition***

A lost workday case is a work-related injury or illness that involves days away from work or days of restricted work activity, or both.

Lost Workday Case (LWC) rate is the number of lost workday cases per 200,000 hours worked.




*Source: DOE Data - Computerized Accident/Incident Reporting System; Private Sector Data - Department of Labor, Bureau of Labor Statistics.*

***Key Observations***

- The preliminary annual estimate for the 1996 LWC rate, 1.6 cases per 200,000 hours worked, fell below the average (92Q1-96Q3) of 1.8 cases per 200,000 hours worked. The 1996 annual LWC rate is the lowest for DOE contractors for the 5-year period 1992-1996. The 96Q4 rate is the lowest quarterly rate since the current data collection system began in 1990.

- In 1996, nearly 50% of all lost workday cases reported (2,107 cases) were serious enough to require days away from work. DOE-wide, the average number of lost workdays per case was 22.8. Workers in production and security activities averaged 27.9 and 30.7 lost workdays per lost workday case, respectively. Other operation types experienced averages lower than the DOE-wide average of 22.8.

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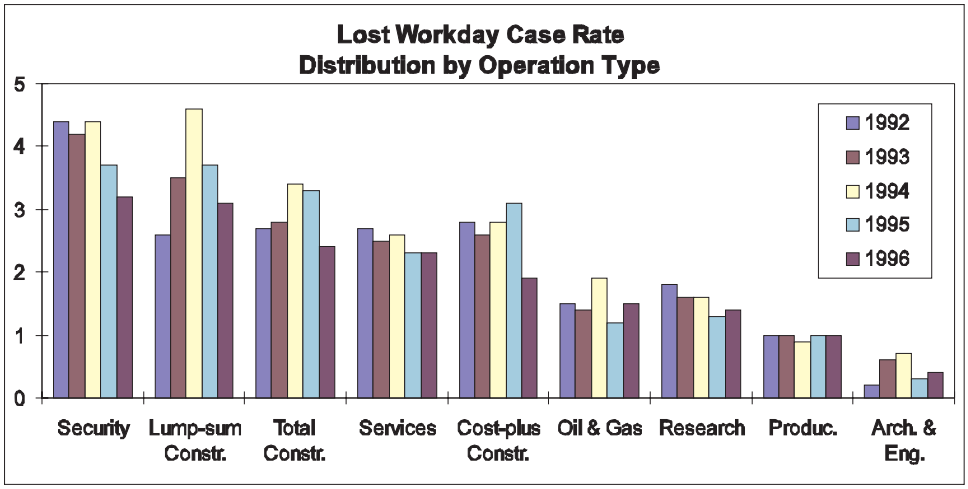
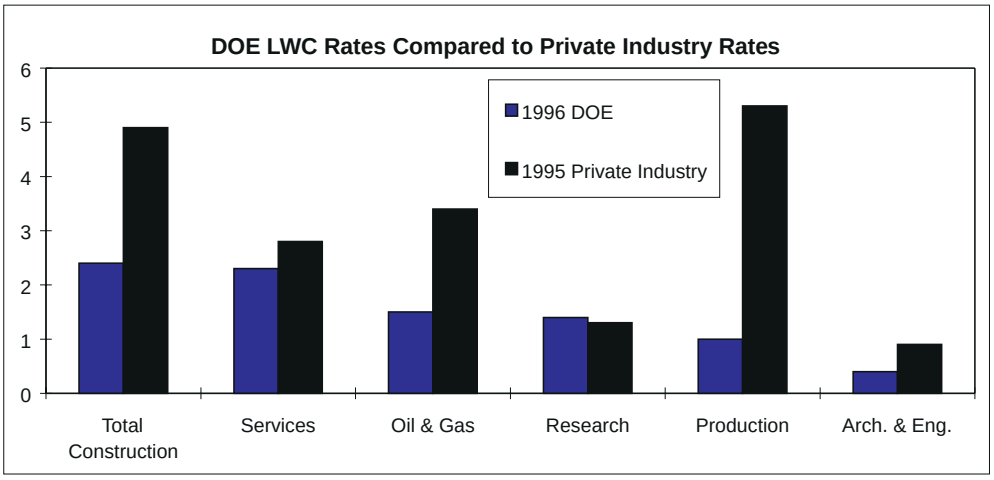
***Additional Analysis***

- Lost workday cases continue to account for about 45% of total recordable cases.

- The following graph shows LWC rates for the past five years distributed by operation type. Security and lump-sum construction operations accounted for the largest lost workday case rates during 1996. 64% of cases occurring in security operations involved days away from work.




- Very general rate comparisons for some operation types can be made to the Department of Labor, Bureau of Labor Statistics (BLS) private industry classifications. The work performed by contractors for DOE falls into several industry classifications, including general building construction, production of chemicals and allied products, oil and gas extraction, research, and sanitary services. The graph shows a comparison of 1996 DOE LWC rates with 1995 private industry rates (the most recent BLS survey).




- The Office of the Inspector General (IG) recently released a report on the processes used by three DOE contractors to record and report occupational injuries and illnesses. Based on the findings from this evaluation, the IG recommended several actions to validate current processes and to ensure consistency in the data reported. Following implementation of these actions, the Department will be in a better position to identify organizations with record keeping and reporting problems and what impact, if any, under or over reporting have had on overall statistics.

*Indicator*

# 2. Occupational Safety and Health Cost Index

*Definition*

In general terms, the DOE Occupational Safety and Health Cost Index represents the amount of money lost to injuries/illnesses for every hour worked by the total work force. The Index is a coefficient calculated from the direct and indirect dollar costs of injuries. It is not a direct dollar value and is not commonly used in private industry. DOE sites use this index to measure their progress in worker safety and health. The Index is computed as follows:

Cost Index = 100[(1,000,000)D + (500,000)T + (2,000)LWC +
(1,000)WDL + (400)WDLR + (2,000)NFC] / HRS

where

D = the number of deaths,

T = the number of permanent transfers or terminations due to occupational illness or injury,

LWC = the number of lost workday cases,

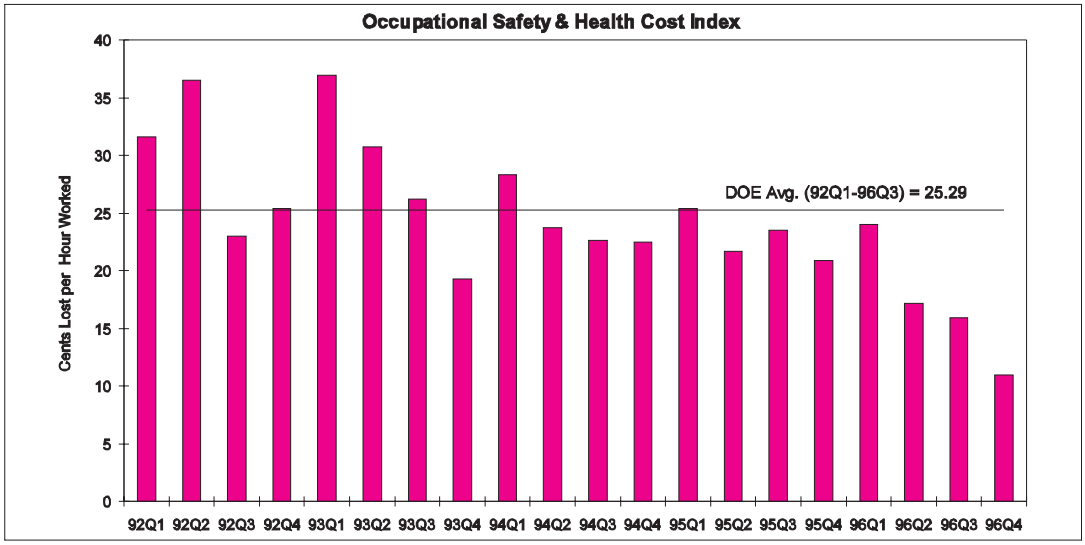
WDL = the number of days away from work,

WDLR = the number of restricted workdays,

NFC = the number of non-fatal cases without days away from work or restricted workdays, and

HRS = the total hours worked.

The coefficients are weighting factors which were derived from a study of the direct and indirect dollar costs of injuries.




*Source: Computerized Accident/Incident Reporting System.*

***Key Observations***

- The Cost Index for each quarter since 95Q2 fell below the average (92Q1-96Q3) of 25.29.

- In 1996, the Cost Index continued to decline to the lowest annual Cost Index recorded (17.10) during the 5-year period 1992-1996. Lost workday cases and days-away-from-work cases have decreased since 1992, and days of restricted work activity have increased slightly. This may reflect field initiatives, such as increased focus on reducing days away from work due to injuries. Revisions and late reporting are expected to result in increases in 1996 estimates.

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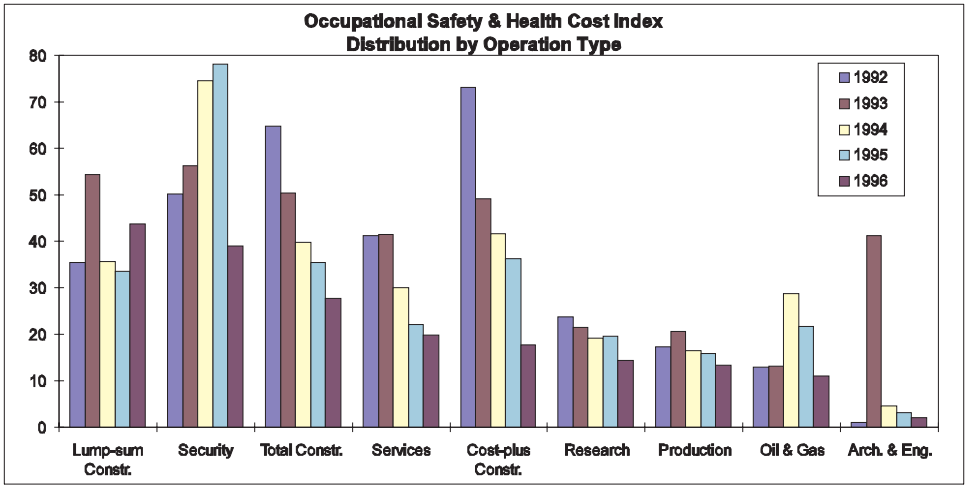
***Additional Analysis***

- The following graph shows the Cost Index distributed by operation type for the past five years. Preliminary estimates indicate that the 1996 lump-sum construction Cost Index increased from the 1995 level and accounted for the largest Cost Index in 1996. Two construction accidents accounted for 39% of this total. The first was a fatality in Idaho resulting from a fall incident in February of 1996. The second was another fall incident, this time at Lawrence Berkley Lab, resulting in a permanent disability to a construction worker. The 1996 Cost Index for all other operation types declined below the 1995 level. The largest decrease was for security operations.

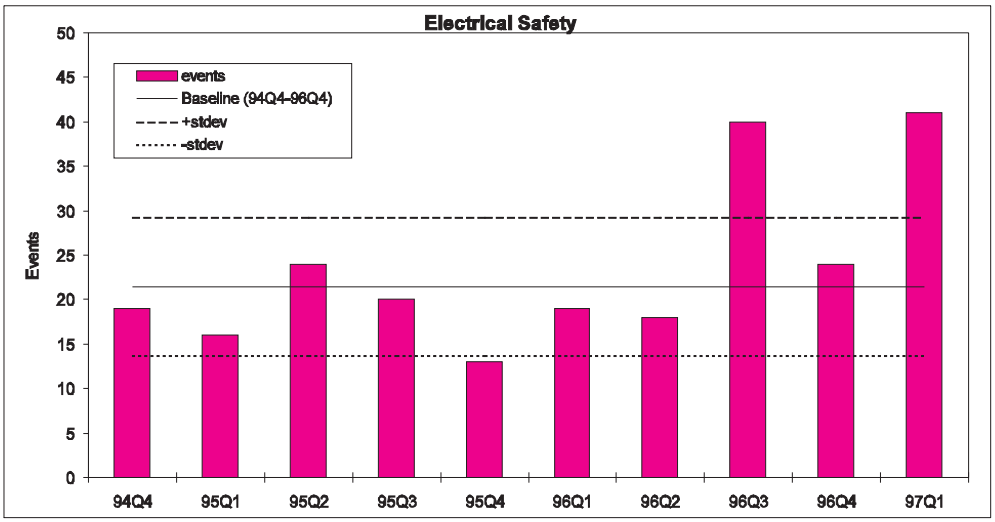


*Indicator*

# 3. Electrical Safety

*Definition*

The number of events involving worker contact or the potential for contact with electrically energized equipment. These events are reportable under DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*.




*Source: Review of Occurrence Reports by Department analysts.*

*Key Observations*

- In 97Q1 there were no serious shock injuries.
- The number of events in 97Q1 (41) is significantly higher than in 96Q4 (24). Over three-fourths of the increase this quarter is due to increased reporting at three sites: Los Alamos, Savannah River, and Rocky Flats.
- During the past 6 quarters there has been an upward trend in the number of reportable events. Part, but not all, of this upward trend is due to an increased emphasis in identifying potential electrical hazards while categorizing these events. However, other analysis by DOE has shown that over the past 7 years of ORPS data there was no statistically significant change in the number of electrical occurrences. The distribution of monthly variation is within the expected range from random variation.

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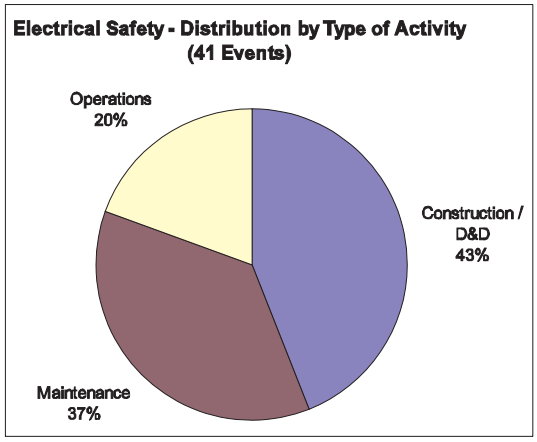
*Additional Analysis*

- Of the 41 electrical safety events reported in 97Q1 only 6 involved a person actually sustaining a shock or injury. This is about the same as in 96Q4 where there were 4 actual shocks and no serious injuries.
- Only 26 of the 41 events reported this quarter identified the root cause. Of the 26 root causes identified, 15 listed some type of personnel error.

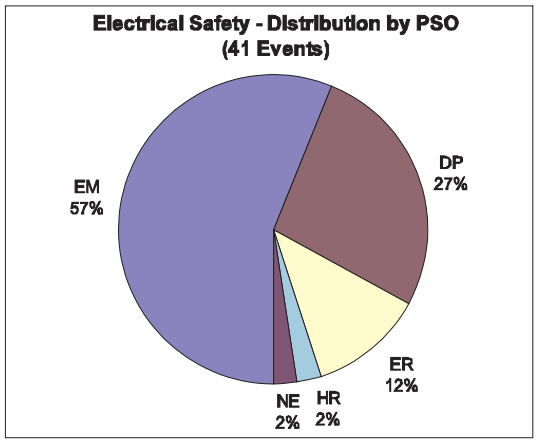
## Distribution by Activity

- The following chart depicts the 41 electrical safety events distributed by activity type.




## Distribution by PSO

- The following chart represents the 41 electrical safety events distributed by PSO.

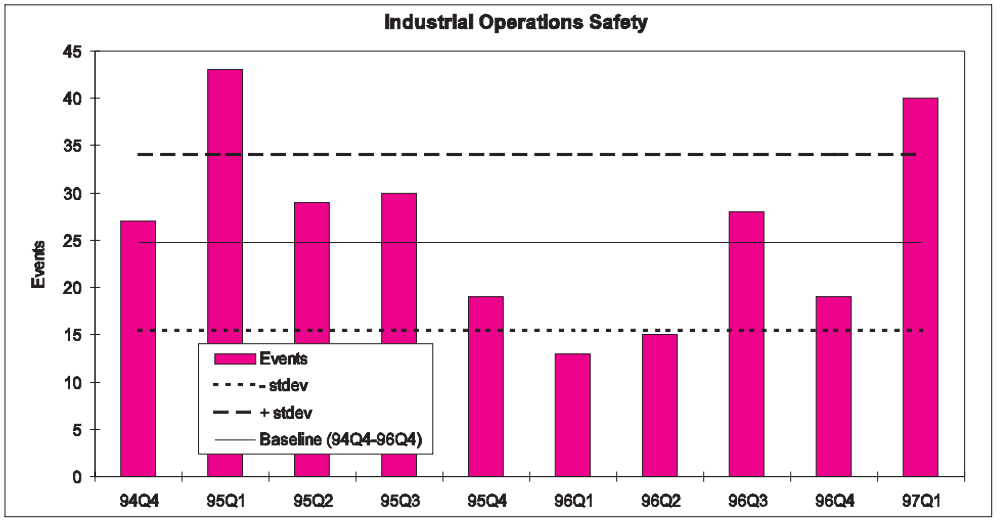


***Indicator***

# 4. Industrial Operations Safety

***Definition***

The number of operations-related events involving construction equipment, machining operations, forklift operations, hoisting, rigging, or excavation reportable under DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*.




*Source: Review of Occurrence Reports by Department analysts.*

***Key Observations***

- Industrial operations safety-related events have more than doubled in 97Q1 as compared with 96Q4 (40 versus 19).
- The relative severity of events, as indicated by the number of unusual occurrences, also increased from 2 to 5 between the two most recent quarters.

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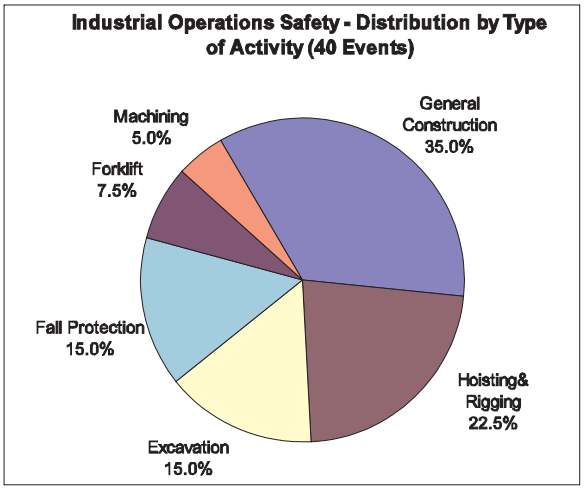
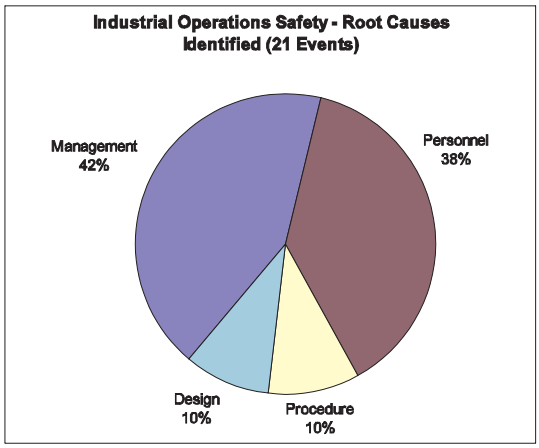
***Additional Analysis***

- In 97Q1, there were 5 reportable personal injuries, including a fatality, which resulted from industrial operations.
- As shown in the graph, general construction activities contributed 35% (14 events) of the total 40 industrial operations safety events in 97Q1. The same activities contributed only 26% (5 events) of the total 19 events in 96Q4.



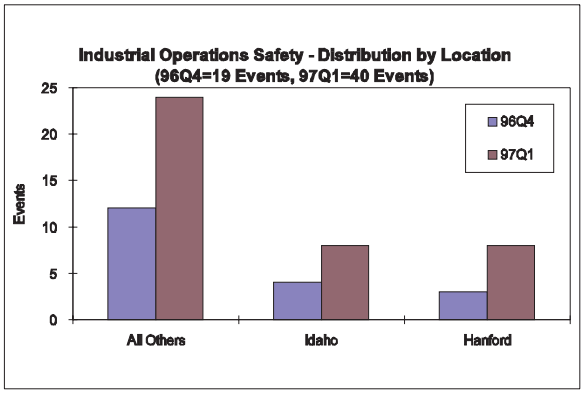
## Distribution by Root Cause

- The chart depicts the root cause distribution for the industrial safety events where a root cause was identified.



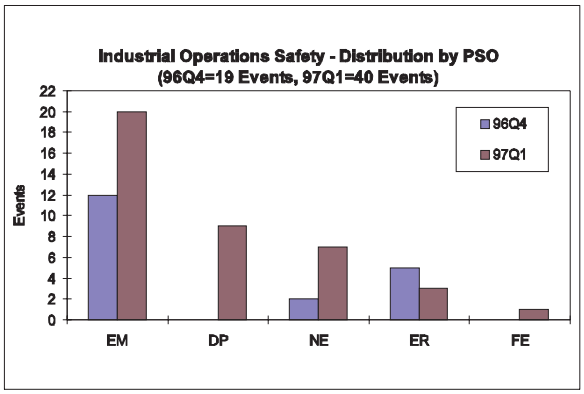

## Distribution by Location

- The distribution by location, including a comparison with 96Q4, is shown in the chart.




## Distribution by PSO

- Distribution by Program Secretarial Offices (PSO) is shown in the chart. Environmental Management (EM), which reported 20 events in 97Q1, continued to be the leading PSO responsible for industrial operations-related events for the quarter. Defense Programs' (DP) contribution increased from no events in 96Q4 to 9 events in 97Q1.



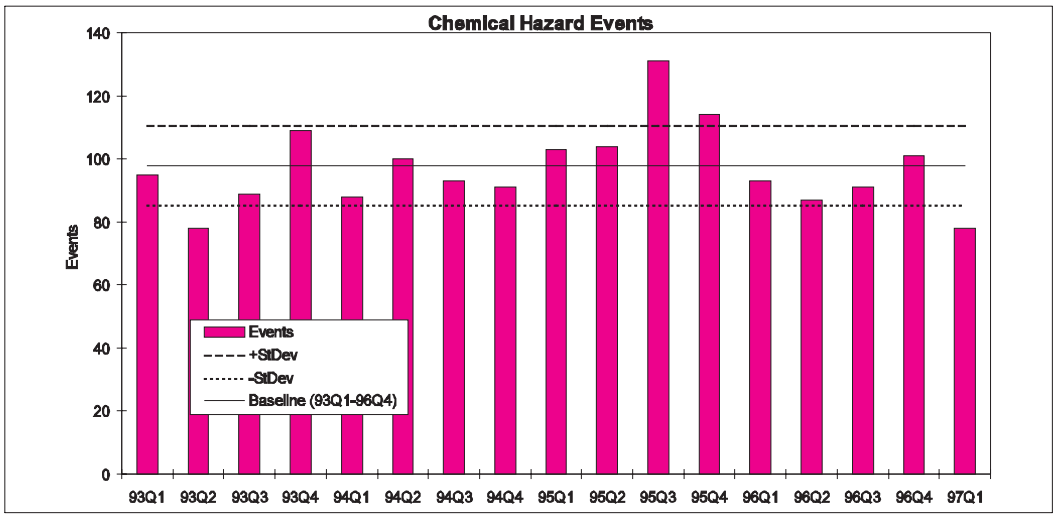
*Indicator*

# 5. Chemical Hazard Events

*Definition*

The number of events reportable under DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*, that are gathered by a word search for specific chemical names. The selected events are reviewed and screened for conditions meeting one of the following categories:

- Class 1 - An injury or exposure requiring hospital treatment or confirmed, severe environmental effect.
- Class 2 - Minor injury (first aid) or exposure, or minor environmental damage.
- Class 3 - Potential precursors to the occurrences in Class 1 or 2.
- Class 4 - Minor occurrences such as leaks, spills, or releases which are significant by the frequency, but not by the consequences.




*Source: Chemical Safety Concerns: A Quarterly Review of ORPS October-December 1996. US Department of Energy, Office of Field Support, EH-53 (draft as of 1-23-97). World Wide Web at: http://www.dne.bnl.gov/etd/csc/*

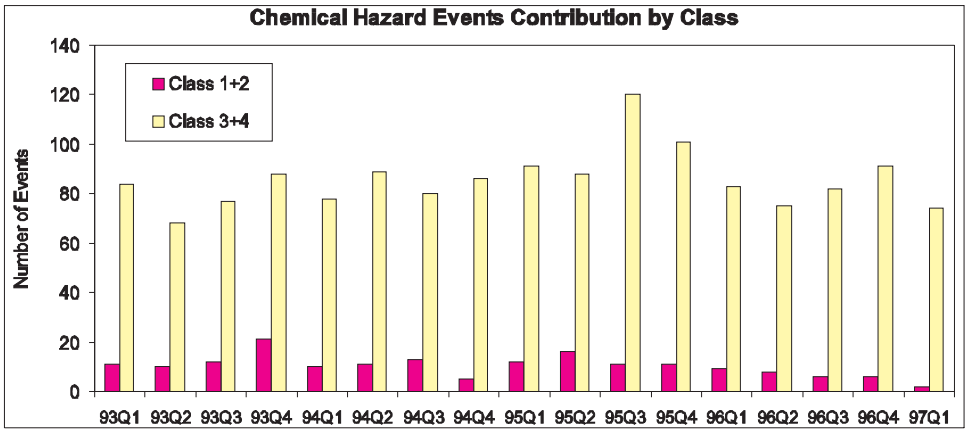
*Key Observations*

- After increasing since 96Q2, the number of chemical hazard events has fallen to an all time low in 97Q1 (78).
- Class 3 and 4 (less severe) events continue to comprise about 89% of the overall chemical hazard events. Over the past 17 quarters (93Q1-97Q1), there is a decreasing trend in the number of Class 1 and 2 events.

## Characterization of Chemical Hazard Events

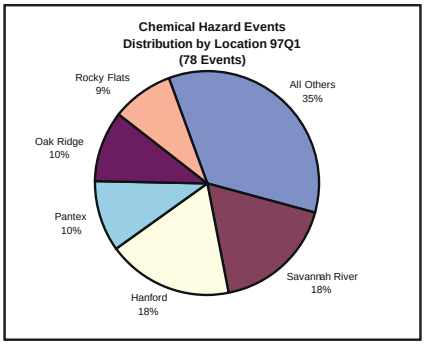
*Additional Analysis*

- During 97Q1, there were no Class 1 events and two Class 2 events identified. One Class 2 event involved a potential exposure to a nicotine-like substance in a laboratory setting; the other Class 2 event involved an exposure to ammonia when a hazardous waste drum lid blew off.




## Distribution by Location

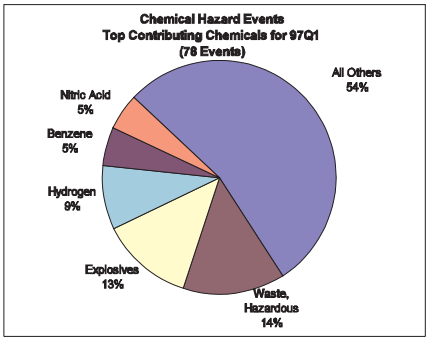
- The major contributors to chemical hazard events in 97Q1 are identified in the chart. Savannah River and Hanford account for 33% of the events in 97Q1. There is a decreasing trend in the number of chemical hazard events observed at Savannah River since 95Q3. Since 96Q2, there is an increasing trend in the number of events at Hanford.




## Distribution by Chemicals Involved

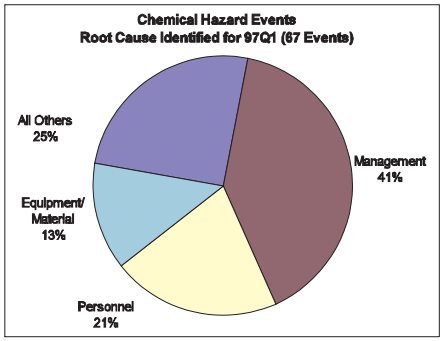
- The chemicals most often involved in chemical hazard events (i.e., top contributing chemicals) during 97Q1 are identified in the chart. Hazardous waste, explosives, and hydrogen were the leading contributors. Explosive events took place almost exclusively at Pantex and Lawrence Livermore National Laboratory (LLNL) and were Class 3 or 4. Hydrogen events occurred largely at Savannah River and were Class 3 or 4.

- $UF_6$ was involved in only 1 chemical hazard event identified during 97Q1. Chemical hazard events involving $UF_6$ have decreased since 95Q4, corresponding with the implementation of an agreement that United States Enrichment Corporation (USEC) no longer is required to report off-normal events to DOE.




## Distribution by Root Cause

- The root cause distribution for 97Q1 is shown in the chart for those events in which a root cause has been identified. 75% of root causes identified were management problems, equipment/material problems, or personnel errors.



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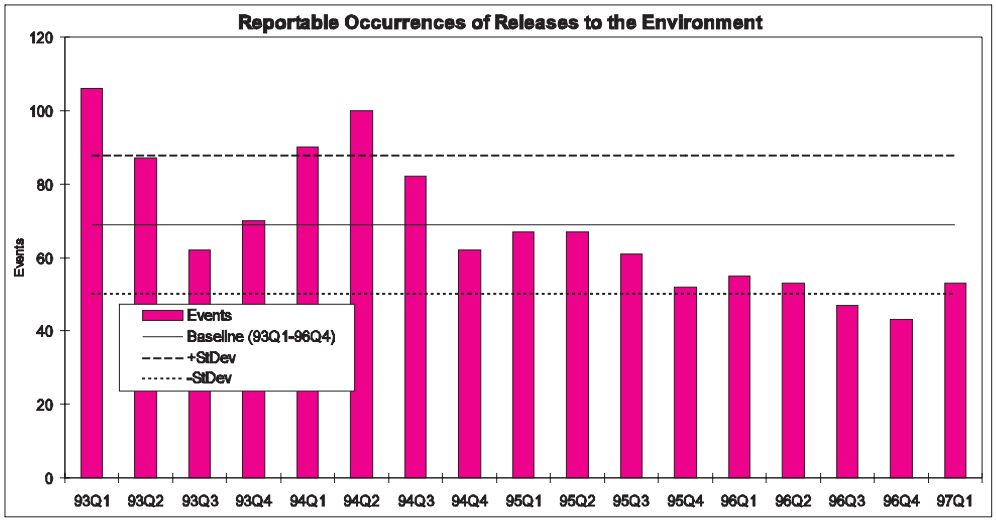
*Indicator*

# 6. Reportable Occurrences of Releases to the Environment

*Definition*

Releases of radionuclides, hazardous substances, or regulated pollutants that are reportable to federal, state, or local agencies.




*Source: Review of Occurrence Reports by Department analysts.*

*Key Observations*

- Reportable release incidents increased from 43 in 96Q4 to 53 in 97Q1.
- The data continue to show a downward trend over the past 17 quarters.

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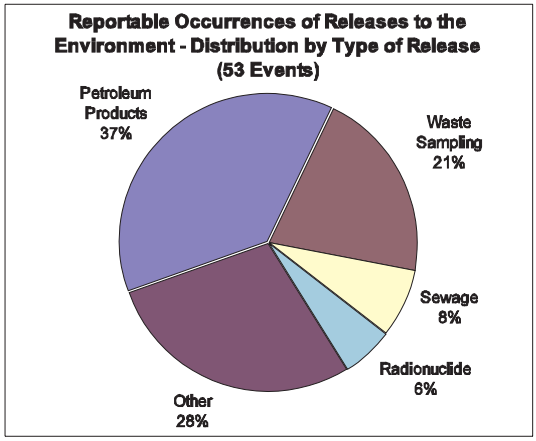
*Additional Analysis*

- Half of the increase in 97Q1 can be attributed to the Brookhaven National Lab site. Reportable releases at Brookhaven increased from one in 96Q4 to seven this quarter. One release at Brookhaven reflects a tritium leak to groundwater which was ongoing for years, and which was detected with the recent installation of new monitoring wells.

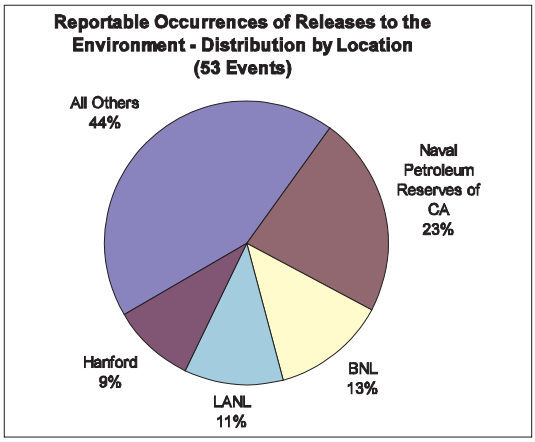
**Types of Events**

- Various types of releases for 97Q1 are shown in the chart. With 12 reportable events, the Naval Petroleum Reserve remains the predominant source of events. The total amount of oil spilled by the Naval Petroleum Reserve was 461 barrels with a recovery of 350 barrels. The recovery rate is 76%. The actual amount of net spillage is about 111 barrels.



## Distribution by Location

- During the current quarter, the 53 environmental release events were distributed at 10 operations offices. Only 4 locations contributed 5 or more events. The following chart depicts the distribution by location.




## Distribution by Root Cause

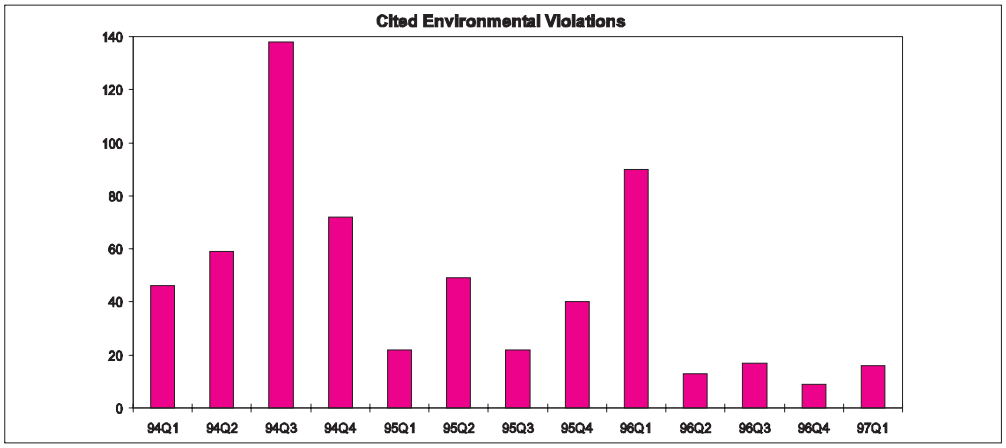
- The reported root cause categories are evenly distributed over the 8 categories except for Equipment/Material, which contributed 13 of the 39 (33%) root causes identified. About half (54%) of the Equipment/Material causes were reported by the Naval Petroleum Reserve, operated by Bechtel Petroleum Operations, Inc.

*Indicator*

# 7. Cited Environmental Violations

*Definition*

Number of environmental violations cited in enforcement actions by regulators at DOE facilities.




*Source: EH-41 Compliance Database*

*Key Observations*

- The Resource Conservation and Recovery Act (RCRA) accounts for about three-fourths of the cited violations (as it did in the previous four quarters).
- RCRA accounts for most fines greater than $10,000.

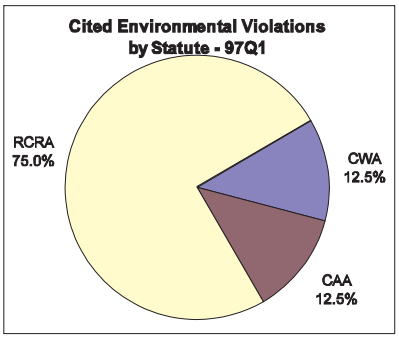
---

*Additional Analysis*

- The majority of the violations are related to the following statutes:
  - Resource Conservation and Recovery Act (RCRA),
  - Clean Air Act (CAA),
  - Clean Water Act (CWA), and
  - Toxic Substances Control Act (TSCA).

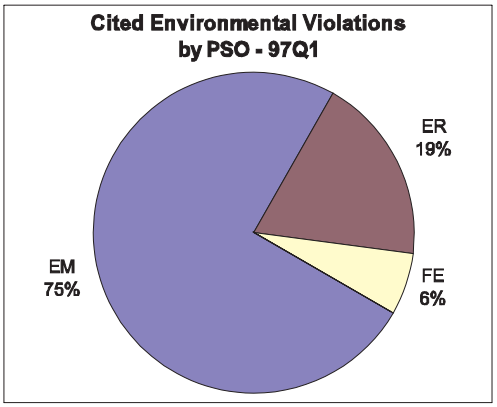
**Violations by Statute**

- RCRA accounts for three-quarters of the cited violations in 97Q1.



## Violations by Program Office

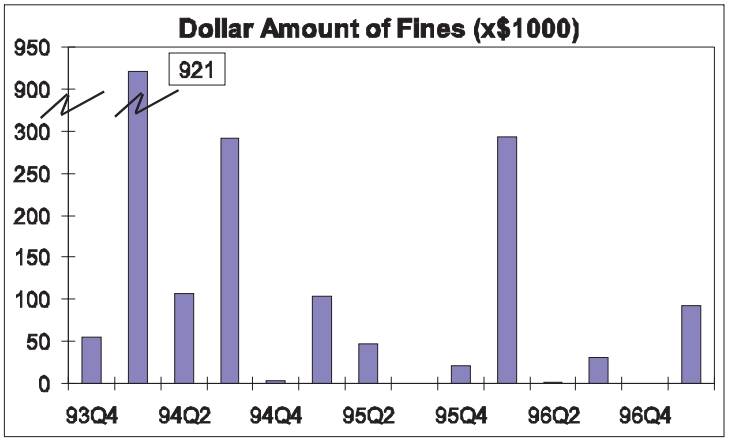
- Three-quarters of the violations cited in 97Q1 were for activities under the Office of Environmental Management (EM).

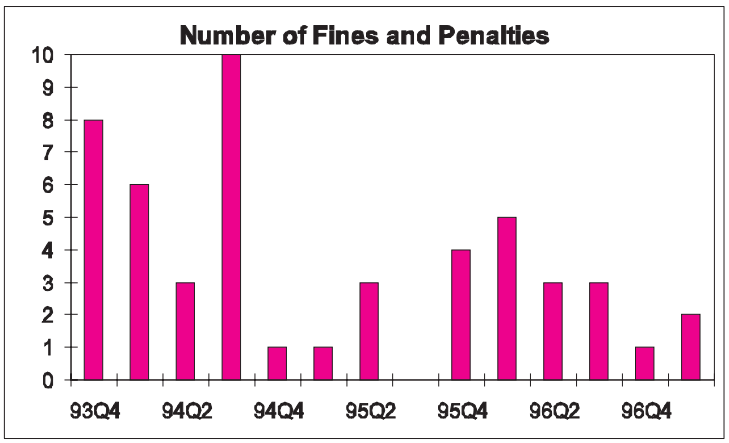



## Amount of Fines and Number of Fines

- Fines assessed in 97Q1 include one under RCRA for $90,000, and one under the CAA for $2,500.

- Fines of $10,000 or more assessed since 95Q4 comprise six under RCRA and one under TSCA.



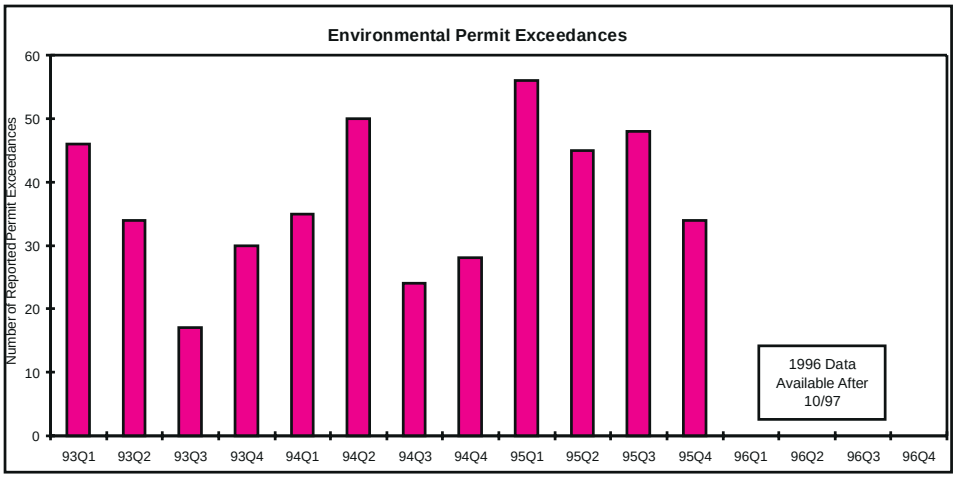
***Indicator***

# 8. Environmental Permit Exceedances

***Definition***

Exceedance of release levels specified in air and water permits during the quarter.

*No changes to this section since last report. Data available after 10/97*




***Key Observations***

- The number of permit exceedances has increased each year from 1993 through 1995.
- In 1995, as in previous years, the great majority (94%) of exceedances are due to violations of permits under the Clean Water Act for discharge to surface waters.
- A few sites account for the majority of DOE's permit exceedances. In 1995, six sites accounted for more than half of the permit exceedances. From 1993 through 1995, five facilities accounted for more than half of the permit exceedances.

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***Additional Analysis***

- Most exceedances (94%) continue to occur under National or State Pollution Discharge Elimination System Permits mandated by the Clean Water Act to protect surface waters by limiting effluent discharges to receiving streams, reservoirs, ponds, etc.
- Other permit exceedances occurred under Clean Air Act permits (3%) and ground-water discharge permits (3%).
- Over the three-year period 1993-1995, five sites accounted for more than half of the exceedances, and 9 sites accounted for 70% of the exceedances. In 1995, six sites (although not the identical list) accounted for more than half of the permit exceedances.
- Six sites had exceedances in at least 10 of the 12 quarters reported; however, two of these sites showed significantly fewer exceedances than in the previous two years.

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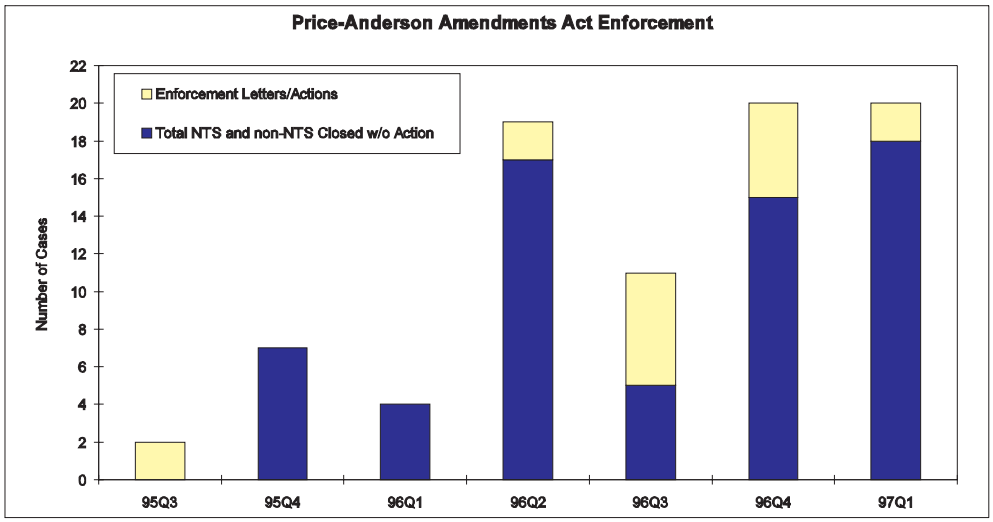
*Indicator*

# 9. Price-Anderson Amendments Act Enforcement

*Definition*

Total number of cases the Price-Anderson Amendments Act[a] (PAAA) Enforcement Office reviews per quarter.




*Source: Office of Enforcement and Investigation database.*

*Key Observations*

- The number of cases the PAAA Enforcement Office reviewed quarterly has increased since the office began enforcement, due to completion of the enforcement program infrastructure development which included establishing noncompliance reporting systems, issuing guidance documents, conducting training, and disseminating information.

---

*Additional Analysis*

- One Enforcement Letter and one Preliminary Notice of Violation (PNOV) and Proposed Imposition of Civil Penalty were issued in 97Q1. Enforcement letters are issued to contractors where events lack sufficient safety significance or where the contractor identified and corrected a problem before a significant event occurred. PNOV's with Civil Penalties are issued in cases where contractor management did not identify a problem.

- The PNOV and proposed $25,000 civil penalty were issued to Lockheed Martin Idaho Technologies Company for radiological and work control deficiencies associated with the unplanned internal radiation exposures to five workers. The Enforcement Letter was issued to Los Alamos National Laboratory because nine employees at Building TA-55 had not received radiological worker training before being exposed.

- Of the 18 cases reviewed and closed without action by the PAAA Enforcement Office in 97Q1, 10 items were identified in the Noncompliance Tracking System (NTS) and 8 were identified independently. NTS is a database of contractor identified (self-reported) non compliances that are potentially more significant.

## Reference

10 CFR Parts 820.11, 830.120, and 835.

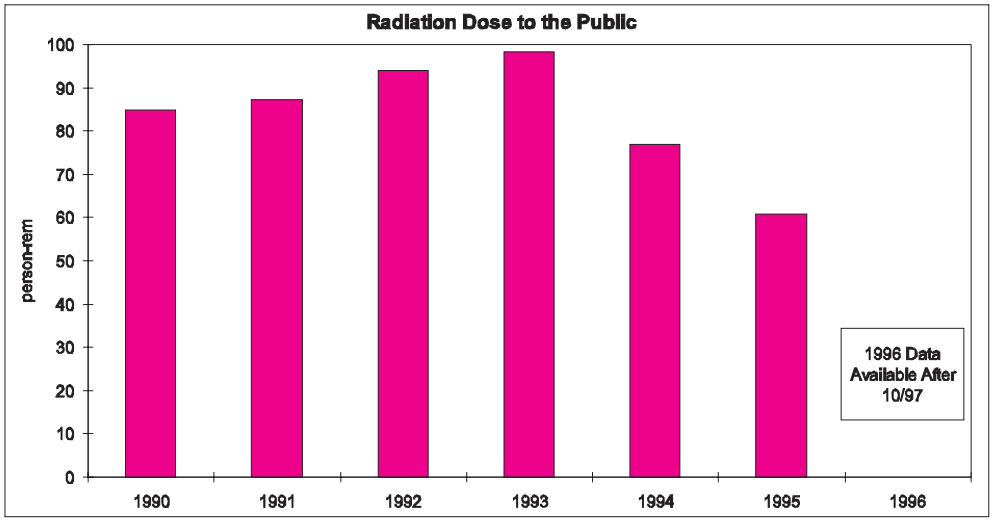
*Indicator*

# 10. Radiation Dose to the Public

*Definition*

Total collective radiation dose (person-rem) to the public within 50 miles of DOE facilities due to radionuclide airborne releases. ("Collective radiation dose" is the sum of the effective dose equivalent to all off-site people within a 50-mile radius of a DOE facility over a calendar year.)

*No changes to this section since last report. Data available after 10/97*




*Source: Annual reports to EPA; EH-41 preliminary tabulation.*

*Key Observations*

- Total collective radiation dose to the public from DOE sources is very low compared to the public dose from natural background radiation. The total collective radiation dose to the public around DOE sites from air releases is one ten-thousandth of the dose received by the same population from natural background radiation.
- Total collective radiation dose to the public in 1995 decreased 21% from the previous year.
- Based on corrected data, total collective radiation dose to the public decreased 22% from 1993 to 1994.
- The decrease in collective radiation dose in 1995 reflects decreases in the dose from Oak Ridge, Lawrence Livermore Site 300, and Savannah River; in 1994 these sites accounted for almost 68% of the dose.

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*Additional Analysis*

- In 1994, Oak Ridge, Lawrence Livermore Site 300, and Savannah River accounted for almost 68% of the total dose.
- In 1995, the dose from Savannah River was 22% the dose reported in 1994, a decrease of 12.5 person-rem. The reduction was due to operational changes at the Replacement Tritium Facility (RTF). The RTF had decreases in tritium oxide emissions and decreases in tritium processing.

- In 1995, the dose from Lawrence Livermore Site 300 was 45% the dose reported in 1994, a decrease of 9.3 person-rem. The reduction reflects a lower level of operation at the Building 513 Stabilization Unit.

- In 1995, the dose from the Oak Ridge Reservation was 63% the dose reported in 1994, a decrease of 7 person-rem. The reduction is due to operational changes at the Y-12 plant.

- While the dose from several other sites increased from 1994 to 1995, there was still a net decrease of 21% below the 1994 population dose.

- An increase of 7.8 person-rem in the calculated dose from Lawrence Berkeley National Laboratory appears to reflect the use of local wind data for 1995 instead of Oakland Airport data as in previous years.

***Indicator***

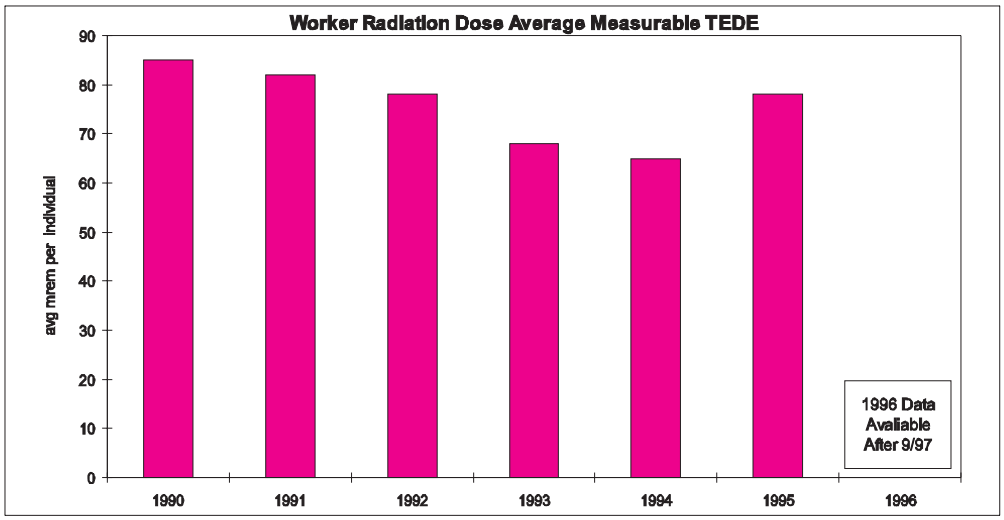
# 11. Worker Radiation Dose

***Definition***

The average measurable dose to DOE workers, determined by dividing the collective total effective dose equivalent (TEDE) by the number of individuals with measurable dose.

TEDE is determined by combining both internal and external contributions to an individual's occupational exposure. The number of individuals receiving measurable dose is used as an indicator of the exposed work force size. It includes any individual (federal employees, contractors, subcontractors, and visitors) with reported doses greater than the minimum detectable dose.

*No changes to this section since last report. Data available after 10/97*




*Source: DOE/EH-52 and DOE Occupational Radiation Exposure Report 1995, DOE/EH-52, U.S. Department of Energy, December 1996 draft.*

***Key Observations***

- The average TEDE per individual with measurable exposure decreased from 85 mrem in 1990 to 78 mrem in 1995. For comparison, the average exposure for the U.S. population from medical diagnostic x-rays is about 40 mrem.[a]
- For the first time in six years, average radiation dose per person is increasing. A good portion of this increase in 1995 is attributed to increased decontamination and decommissioning work.
- 80% of the collective TEDE is accrued at just six of the highest-dose DOE sites: Savannah River, Rocky Flats, Hanford, Los Alamos, Idaho, and Brookhaven.
- Occupational radiation dose reported by DOE has been impacted over the past 5 years by changes in operational status of DOE facilities, reporting requirements, and radiation protection standards and practices.

---

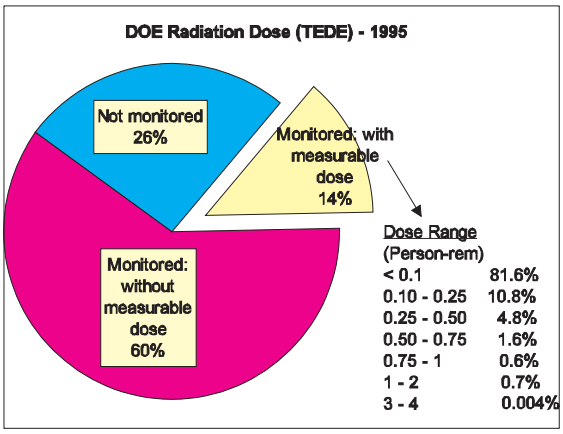
***Additional Analysis***

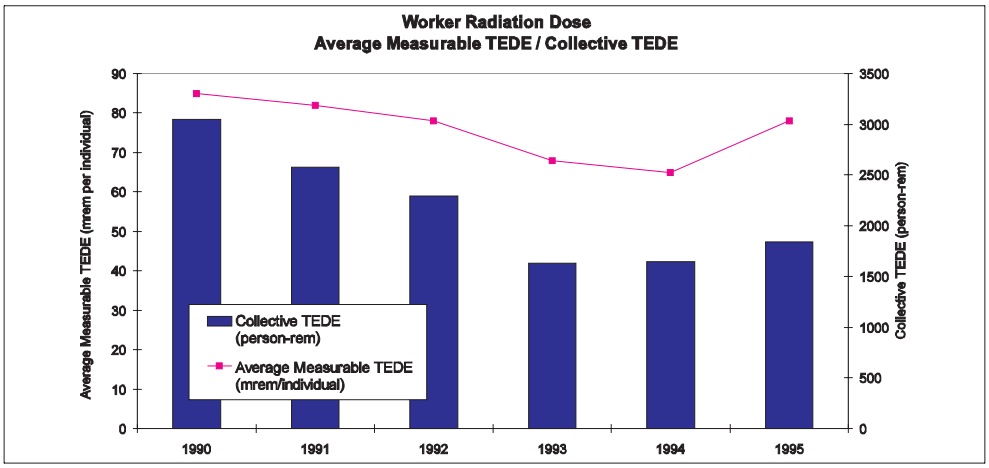
- Additional information concerning exposure received by individuals associated with DOE activities is included in the DOE Occupational Radiation Exposure Report 1995 (December 1996 draft).

## DOE Doses

- In 1995, 74% of the 172,178 DOE workers and contractors were monitored; 19% of those monitored received a measurable dose.

- No individuals exceeded the DOE TEDE limit of 5 rem. 92% of the workers with a measurable dose received a dose of less than 0.25 rem. Doses in excess of the ACL and the DOE TEDE dose limit have decreased over the past 6 years. Most of this decrease is because of the change in methodology for determining internal dose discussed below.




- The collective TEDE (the sum of the TEDE received by all monitored individuals) for 1995 was 1840 person-rem. The graph above indicates the decline in both average dose and collective dose.

## Distribution by Site

- The six leading contributors to the collective TEDE for 1995 comprised 80% of the total DOE dose. Five of the six sites reported increases which resulted in a 12% increase in the DOE collective dose from 1994 to 1995. The sites provided the following information on activities that contributed to the collective dose for 1995.

  - Los Alamos: Most of the 24% increase (from 190 to 235 person-rem) was attributed to increased work on the production of power sources for NASA.

  - Brookhaven: Most of the 58% increase (from 92 to 146 person-rem) is attributed to an 82% increase in the days of operation and intensity of the Alternating Gradient Synchrotron accelerator. Increased frequency of maintenance surveys conducted on aging equipment was also a contributing factor.

- Idaho: Most of the 20% increase (from 237 to 284 person-rem) is attributed to increased operations at Idaho Chemical Processing Plant (ICPP). Two key ICPP facilities were deactivated in 1995.

- Rocky Flats: Most of the 12% increase (from 232 to 261 person-rem) is attributed to increased decontamination/decommissioning activities and material stabilization work. Consolidation of special nuclear material and processing of potentially unstable residues for safe storage began in 1995.

- Hanford: Most of the 35% increase (from 215 to 291 person-rem) is attributed to increased use of the tank farm and K Basins associated with nuclear material and facility stabilization.

- Savannah River: The site collective TEDE decreased 19% from 1994 to 1995 (from 315 to 256 person-rem). Operations at the major facilities were about the same in 1995 as in 1994. The Defense Waste Processing Facility (which represented 5% of Savannah River's total in 1994) was restarted near the end of 1995.

## Comparison to Other Sources

Table 1 provides 1995 average occupational exposures for workers with measurable doses for Nuclear Regulatory Commission licensees.

**TABLE 1**
**Comparison to 1995 Average Occupational Exposures for Workers with Measurable Doses[b]**

| License Category | Average Measurable TEDE per Worker (rem) |
|---|---|
| Industrial Radiography | 0.54 |
| Manufacturing and Distribution | 0.49 |
| Low-level Waste Disposal | 0.14 |
| Independent Spent Fuel Storage | 1.04 |
| Fuel Fabrication and Processing | 0.43 |
| Commercial Light Water Reactors | 0.31 |

- The average radiation worker dose received from DOE operations in 1995 was 78 mrem per individual. This should be contrasted to background radiation levels of 27 mrem per individual from cosmic radiation, 28 mrem per individual from terrestrial sources, and 200 mrem from naturally occurring radon sources.[c]

## Changes Impacting DOE Occupational Radiation Dose

- Change in operational status of facilities is the predominant driver behind changes in the collective dose. Significant reductions in the opportunities for individuals to be exposed occur as facilities are shut down and transitioned from operation to stabilization or decommissioning and decontamination.

- Changes to reporting requirements have significantly impacted the collective dose at DOE. The change in internal dose methodology from annual effective dose

equivalent (AEDE) to committed effective dose equivalent (CEDE) between 1992 and 1993 resulted in a reduction of the collective TEDE by 28%, because the dose from prior intakes is no longer reported.

- Radiation protection practices have changed because of the implementation of the Radiological Control Manual (RadCon Manual). The RadCon Manual changed the methodology to determine internal dose, established Administrative Control Levels (ACL), standardized radiation protection programs, and formalized "As Low As Reasonably Achievable" (ALARA) practices.

*References*

[a] *Exposure of the U.S. Population from Diagnostic Medical Radiation,* National Council on Radiation Protection and Measurements, NCRP Report No. 100, Bethesda, MD, May 1989.

[b] M. L. Thomas, D. Hagemeyer, *Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities,1995*, NUREG-0713, Vol. 17, January 1997.

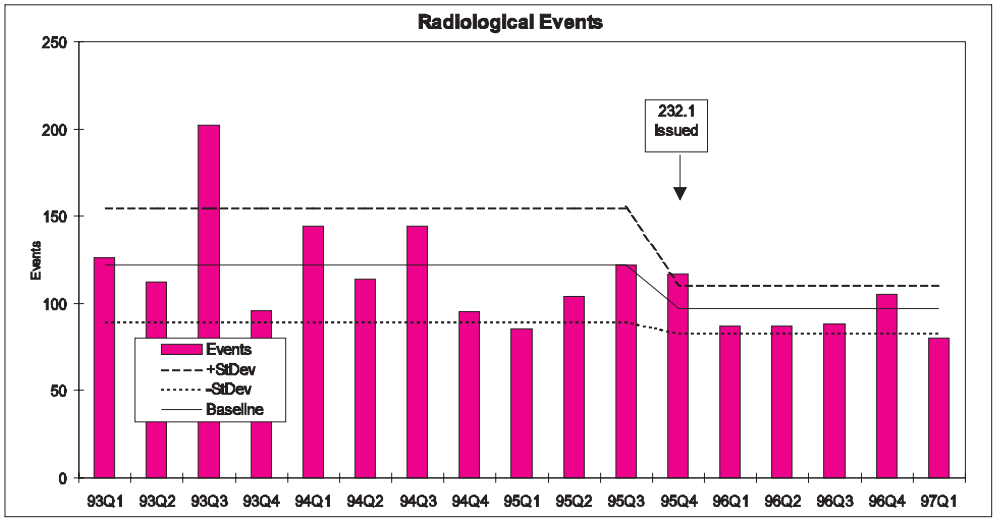
[c] Merril Eisenbud*, Environmental Radioactivity from Natural, Industrial and Military Sources*, 3rd Edition, by Academic Press, Inc.,1987.

*Indicator*

# 12. Radiological Events

*Definition*

Number of reportable radiological events as defined in DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information.* These events are made up of both personnel contaminations and radiation exposures which are reported as personnel radiation protection events.




*Source: Review of Occurrence Reports by Department analysts.*

*Key Observations*

- A decreasing trend is observed over the 17 quarters shown. The most recent 5 quarters, since the implementation of DOE Order 232.1A, demonstrate a reduced number of radiological events when compared to the historical baseline and appear to have no significant trend.

- 94 individuals were involved in the 80 reported radiological events during 97Q1. Of the events reported in 97Q1, 12 involved the contamination of more than one individual.

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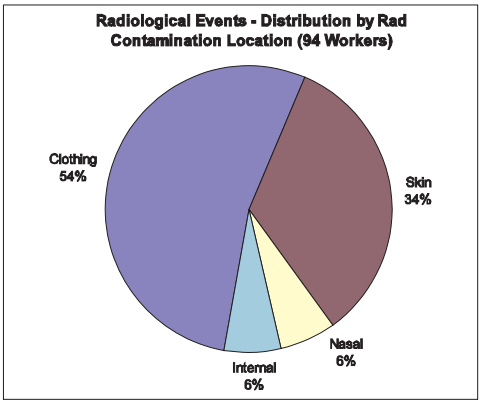
*Additional Analysis*

**Distribution by Contamination Location**

- The events reported in 97Q1 were analyzed as to the location on the individual that the contamination occurred. The following chart depicts this analysis.

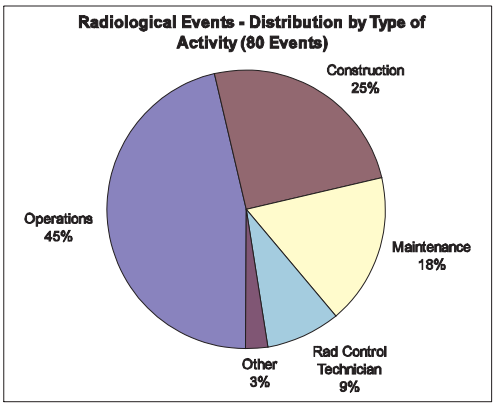
- Of particular significance is the marked increase in confirmed internal contaminations reported, from 2 in 96Q4 to 7 in 97Q1.



## Distribution by Facility Activity

- The events reported in 97Q1 were analyzed as to the type of activity that was taking place at the time of the contamination. The following chart depicts this analysis.

- 45 of the 80 events reported the specific isotope involved in the contamination. Of these events, 16 (36%) were attributable to plutonium 238/239, 11 (24%) were attributable to cesium 137 and 10 (21%) were attributable to cobalt 60.

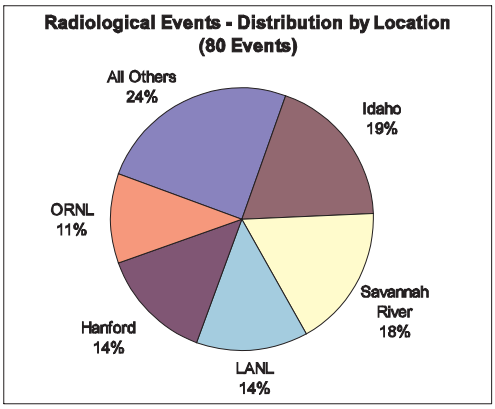



## Distribution by Location

- The following chart depicts the distribution of radiological events by location.

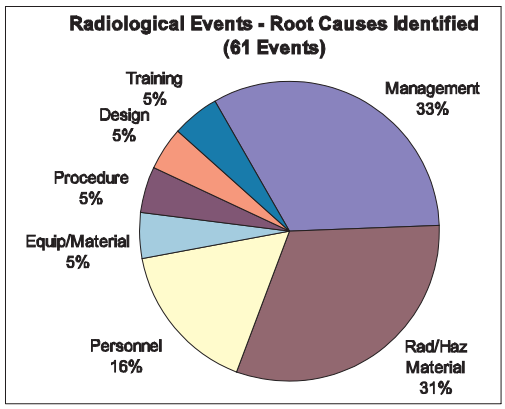
- ORNL has continued to be a major contributor (9 events) to the total number of contamination events within the DOE complex. Of particular note is the fact that 3 positive bioassay's were reported in 97Q1.

- Contamination events at the LANL Chemistry-Metallurgy Research building fell significantly to 2 in 97Q1 from 9 in 96Q4.




## Distribution by Root Cause

- 61 of the 80 reports of radiological contamination included root cause determination. This chart depicts the root cause determination of these 61 events.

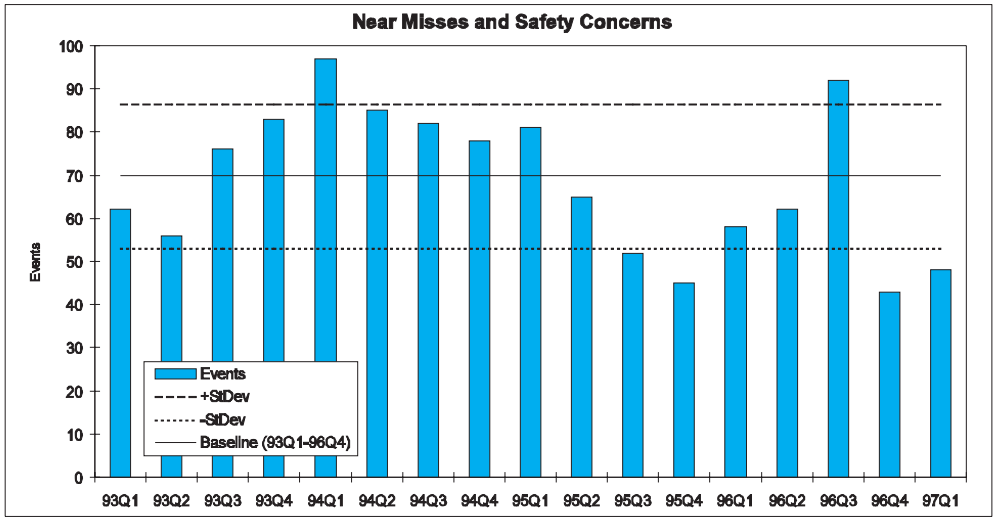


*Indicator*

# 13. Near Misses and Safety Concerns

*Definition*

A near miss is an operational event where barriers to an accident have been compromised such that no barriers or only one barrier remain (e.g., lack of fall protection, electric shock without injury, unauthorized confined space entry). A safety concern includes: the unauthorized use of hazardous products or processes, or if work is shut down as a result of an OSHA violation. Near misses and safety concerns are reportable under DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*.




*Source: Review of Occurrence Reports by Department analysts.*

*Key Observations*

- The total number of near misses and safety concerns events increased from 43 in 96Q4 to 48 in 97Q1. The increase is primarily due to the increase of electrical safety-related events (from 12 to 17). One of the electrical safety-related events was categorized as an unusual event. A Type B investigation has been initiated by the integrating contractor to investigate the event.

- There has been a decreasing trend of these events since 94Q1.

---

*Additional Analysis*

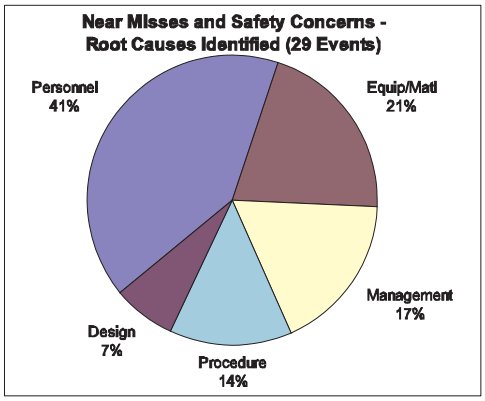
- For the major activities involved in near misses and safety concerns events, a comparison of 97Q1 with the average of the four 1996 quarters follows:

| Type of Activity | 97Q1 | 1996 Average |
|---|---|---|
| Electrical Safety Events | 17 | 20 |
| Fall Protection Events | 5 | 8 |
| Radiation Protection/Hazardous Material Handling Events | 3 | 10 |
| All Other Events | 23 | 26 |

## Distribution by Root Cause

- Among the total 48 near misses and safety concerns events, only 29 events had their root causes identified in 97Q1. They are distributed as shown in the chart.

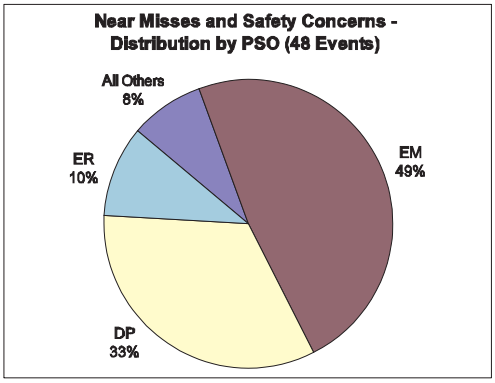
- Four of the six equipment problems were identified as "end-of-life failure" of the equipment.




## Distribution by Program Secretarial Offices (PSO)

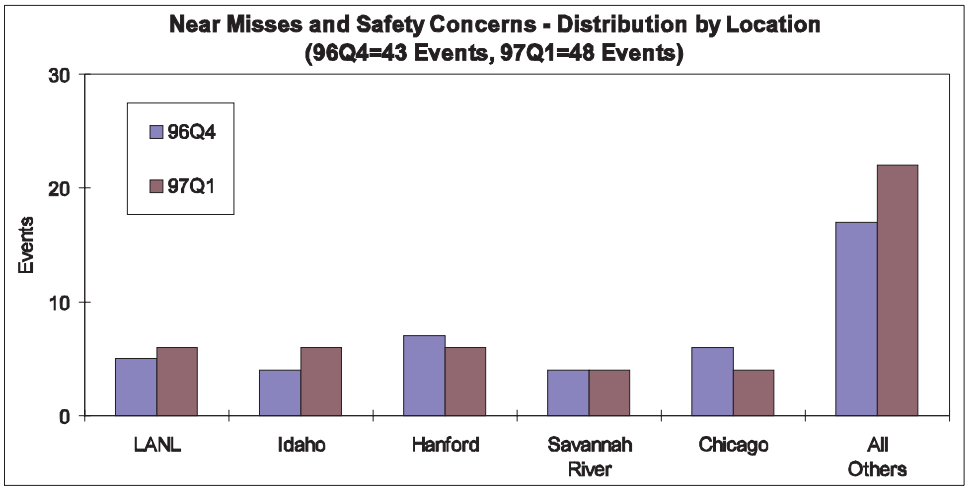
- The distribution by PSO is shown in the chart.

- Of the total 3 unusual events reported in 97Q1, EM experienced 2 and DP experienced 1.




## Distribution by Location

- The distribution by location is shown in the chart.

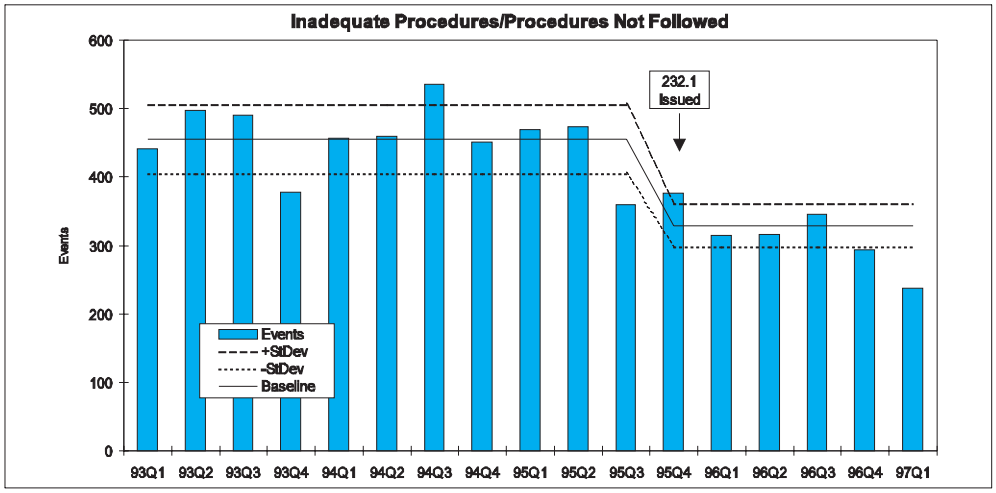


*Indicator*

# 14. Inadequate Procedures/Procedures Not Followed

*Definition*

Number of reportable events as defined in DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*, which are either categorized as procedure violations or problems, or which are reported as being caused by a procedure violation or problem.




*Source: Review of Occurrence Reports by Department analysts.*

*Key Observations*

- A decreasing trend exists since 93Q1. This trend is especially apparent since 94Q3.
- The number of events involving procedure violations or inadequacies in 97Q1 (238) dropped by 19% when compared to the number of events reported in 96Q4 (294). There was a change among the major contributing sites between the 2 quarters. Savannah River, which has consistently been among the top three contributors over the last several quarters, experienced an increase of approximately 5% over 96Q4 events to become the largest contributing site, while the number of events at last quarter's major contributor, Hanford, dropped by about 40%.

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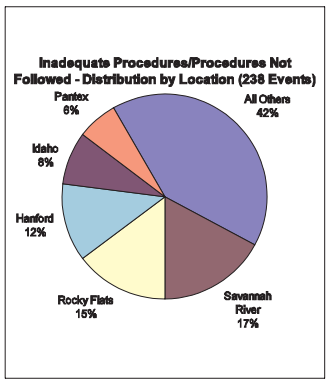
*Additional Analysis*

**Distribution by Location**

- The following chart represents a distribution of the 5 major contributors.
- These same sites have been among the top contributors since 93Q1.
- Savannah River, the second leading contributor in 96Q4 with 39 events, became the leading contributor in 97Q1 with 41 events.
- Hanford, the leading contributor in 96Q4, saw a significant decrease in the number of events in 97Q1 (49 and 29 events, respectively). This appears to be due, in large part, to a drop in the number of events involving the criticality monitoring and ventilation systems.



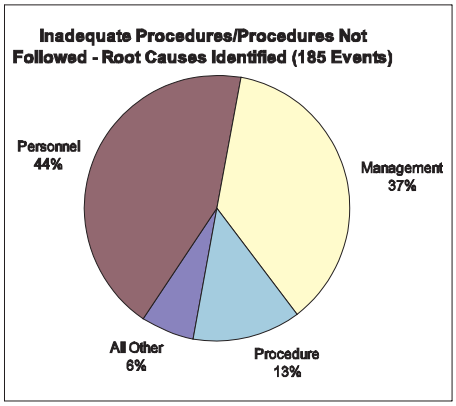
## Distribution by Root Cause

- As has been the case since 93Q1, for those events with root causes identified, the top 3 cited root cause categories for 97Q1 were Personnel (81 events), Management (68 events), and Procedure (24 events).

  - Of the personnel errors cited, inattention to detail and procedures not used or used incorrectly were the top 2 contributors.

  - The top 2 management causes cited were inadequate administrative controls and policies not adequately defined, disseminated, or enforced.

  - Defective or inadequate procedure was the major procedural root cause identified.




  - No root cause was determined for 53 events at the time that the analysis for this indicator was performed.

## Characterization of Events

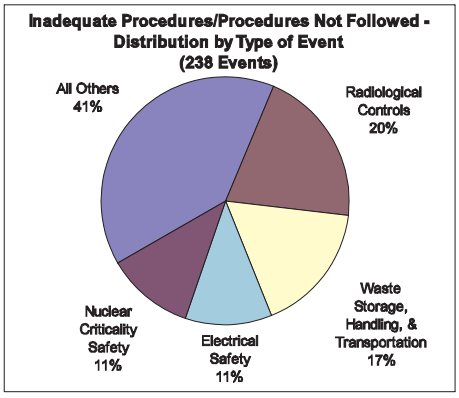
- The major types of events reported during 97Q1 were:

  - Radiological controls-related events-49 (this was also the largest contributor in 96Q4).

  - Waste storage handling and transportation-related events-41.

  - Electrical safety-related events-27.

  - Nuclear criticality safety-related events-27.




- Of these, radiological controls and nuclear criticality safety were among the top four contributors in 96Q4.

- Other significant contributors included events related to personal protective equipment (PPE) and fire protection/fire safety.

- A comparison of those events that involved a violation of existing procedures against those whose procedures were found to be inadequate or non-existent found:

  - Nearly 75% of the events involved a violation of existing procedures.

  - Most of the remaining events involved inadequate procedures.

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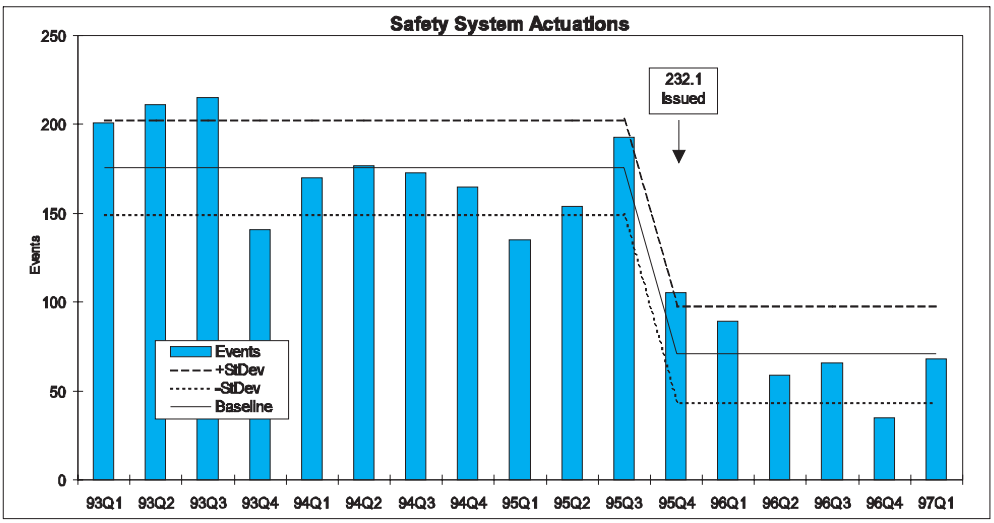
*Indicator*

# 15. Safety System Actuations

*Definition*

Number of operations related events determined to be safety system actuations reportable under DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information.* This includes real actuation of any safety class equipment or alarm, unplanned electrical outages, unplanned outages of service systems, serious disruption of facility activity related to weather phenomenon, facility evacuations, or loss of process ventilation. These events have the potential to impact the safety and health of workers in the vicinity.




*Source: Review of Occurrence Reports by Department analysts.*

*Key Observations*

- An increased number of safety system actuation events is observed in 97Q1 (68) when compared to the average for CY-1996 (62).

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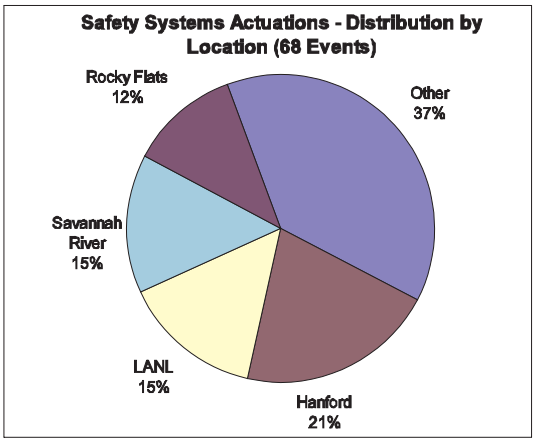
*Additional Analysis*

**Distribution by Location**

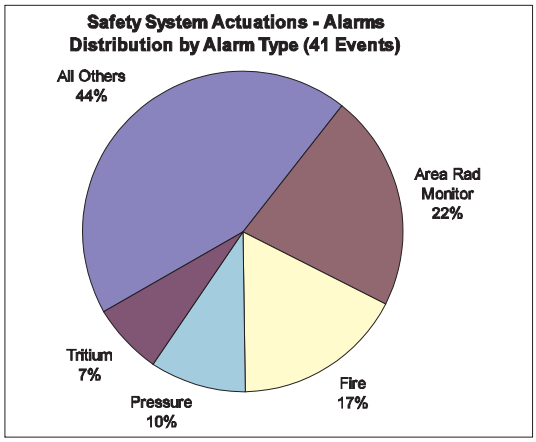
- The distribution by location is shown in this chart.



## Distribution by Alarm Type

- Of the 68 safety system actuations, 41 involved the actuation of alarms. The following chart depicts the distribution of these alarms by the alarm type.

- System failures also constitute a portion of the safety system actuations reported. The two primary contributors are process ventilation system failure (18) and electrical system failure (14).

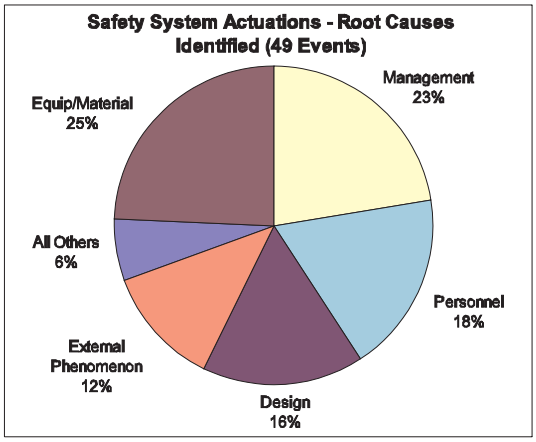



- There was one event this quarter that was categorized as an emergency. This event, at the Rocky Flats Environmental Technology Site, involved the release of 10,000 gallons of water due to freeze-related damage to fire and domestic water lines.

- Of the 68 safety system actuations reported this quarter, 16 resulted in facility evacuations.

## Distribution by Root Cause

- The following chart depicts the distribution of safety system actuation events by root cause, for those events in which a root cause has been identified.



*Indicator*

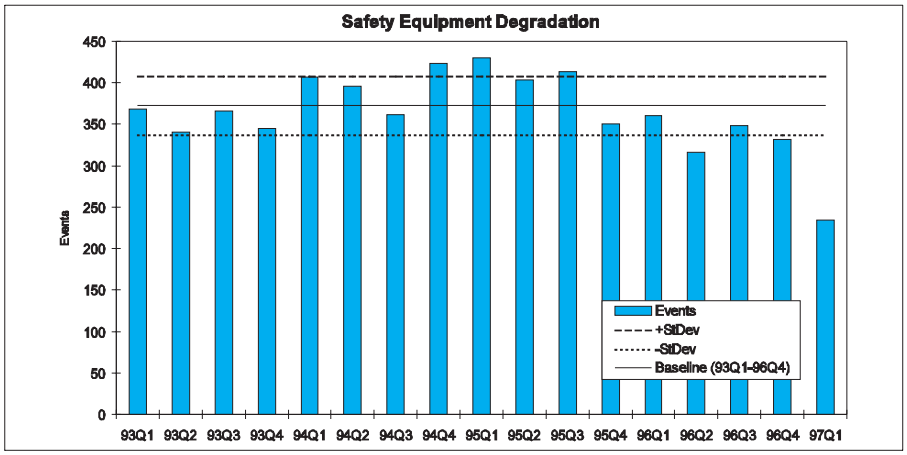
# 16. Safety Equipment Degradation

*Definition*

Number of reportable events categorized as "vital system/component degradation" as defined in DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*.

Safety equipment degradation includes: (1) any unplanned occurrence that results in the safety status or the authorization basis of a facility or process being seriously degraded; or (2) a deficiency such that a structure, system, or component (SSC) vital to safety or program performance does not conform to stated criteria and cannot perform its intended function; or (3) unsatisfactory surveillance/inspections and appraisal findings of any safety class SSC.

- A decreasing trend in safety equipment degradation events has been observed since 94Q1.




*Source: Review of Occurrence Reports by Department analysts.*

*Key Observations*

- There has been a substantial drop over the last quarter (332 in 96Q4 and 234 in 97Q1) that appears to be the result of decreases experienced at several DOE sites including Rocky Flats, Los Alamos National Laboratory, Pantex, Hanford, and Brookhaven National Laboratory.

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*Additional Analysis*

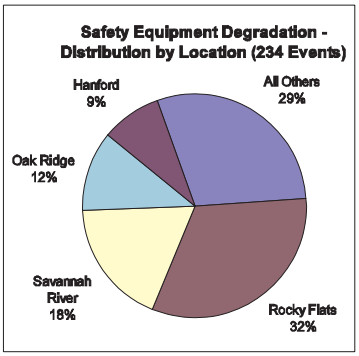
**Distribution by Location**

- The following chart represents a distribution of the 4 major contributors.

  - As was the case in 96Q4, Rocky Flats and Savannah River are the leading 2 contributors.

  - Rocky Flats had 118 events in 96Q4 and 75 in 97Q1, while Savannah River experienced 42 events in 96Q4 and 43 in 97Q1.

  - The substantial drop in the number of events at Rocky Flats appears to be related to a drop in the number of ventilation system related degradations.



- The number of events at Oak Ridge showed a significant increase in 97Q1 (from 17 in 96Q4 to 27 in 97Q1). This increase appears to be a result of an increase in the number of safety status degradation events as well as the number of equipment degradation events involving the Criticality Accident Alarm and Emergency Notification systems at the Y-12 facility.

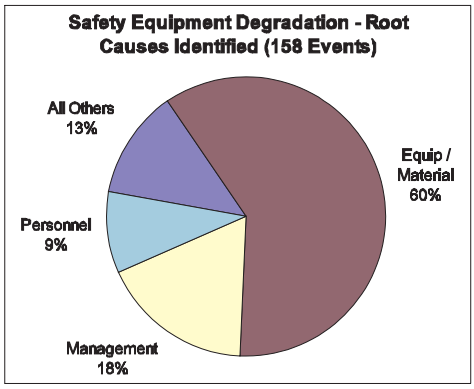
- Hanford, though it was not one of the top contributors in 96Q4, experienced a 20% drop compared to the 96Q4 events.

**Distribution by Root Cause**

- Of the 234 events reported in 97Q1, 158 had established root causes at the time that the analysis was performed. Of these, the following observations were evident:

  - The root cause for 95 of the events was cited as Equipment/Material problems. Of these, the 2 most significant sub-categories of root cause were defective or failed parts (58 events) and end-of-life failure (23 events).

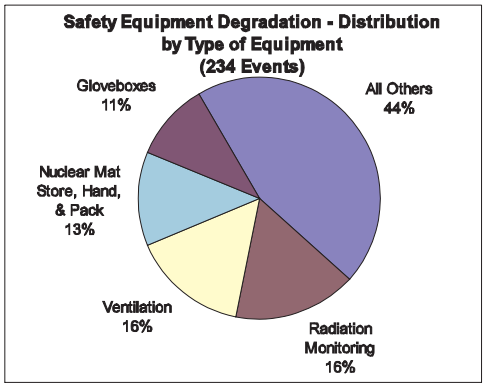
  - The distribution by root cause was consistent with 96Q4 data.




**Distribution by Type of Equipment Involved**

- As is indicated on the chart, the 4 leading categories of degraded equipment involved for 97Q1 were: radiation monitoring equipment; ventilation equipment; nuclear material equipment and systems related to storage, handling and packaging; and gloveboxes.

  - For radiation monitoring equipment, the leading types of equipment, by far, were Selective Alpha Air Monitors (SAAMs) and Continuous Air Monitors (CAMs). These types of equipment contributed almost 70% to the total. Other types of equipment included neutron monitors and tritium detectors among others.



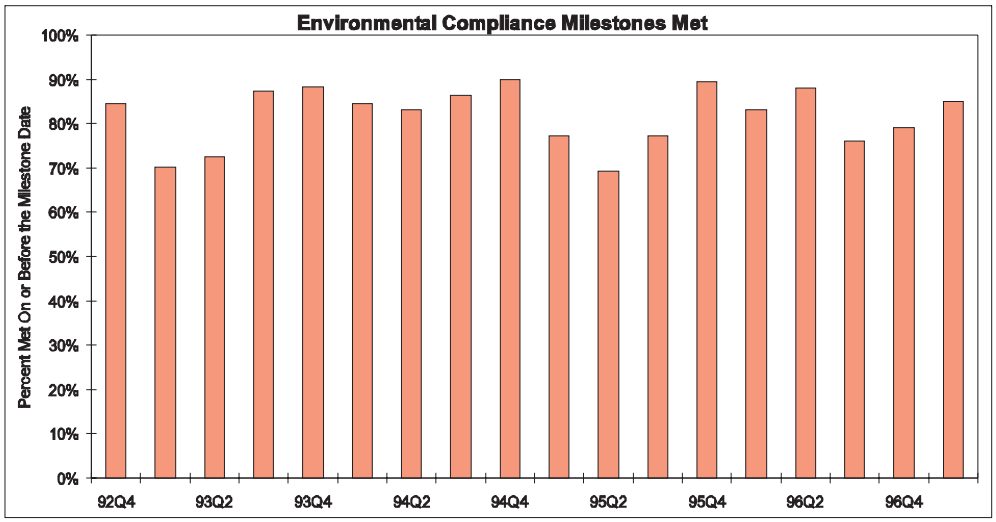

- With respect to ventilation system degradation events, degraded fans were the leading contributor.

*Indicator*

# 17. Environmental Compliance Milestones Met

*Definition*

Enforceable requirements in environmental agreements, met on or before the milestone date (percent).




*Source: Progress Tracking System Data, Office of Environmental Management, EH-41.*

*Key Observations*

- In 97Q1, DOE met 85% of its enforceable compliance milestones. Over the previous four quarters (calendar year 1996) DOE met 81% of its milestones.

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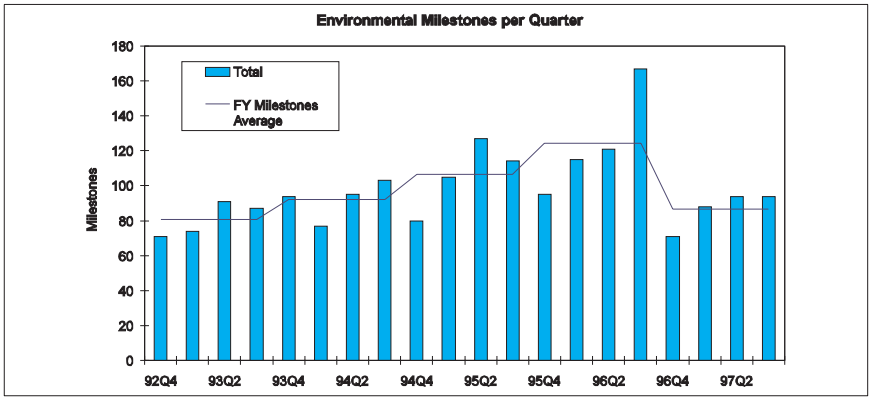
*Additional Analysis*

- There are currently 379 milestones identified for fiscal year 1997. This compares with 498 in FY 1996 and 323 in FY 1993.

- At this time last year, sites projected that 9 milestones would be missed in the third quarter (6% missed); the actual number turned out to be 40 (24% missed). This year, 18 milestones are projected to be missed in the third quarter (16% missed); based on past experience, this may be an optimistic projection.




- These data do not capture all enforceable milestones; they reflect those milestones under the purview of the Office of Environmental Management. EM's Progress Tracking System is believed to capture 85–90% of all DOE enforceable environmental milestones.

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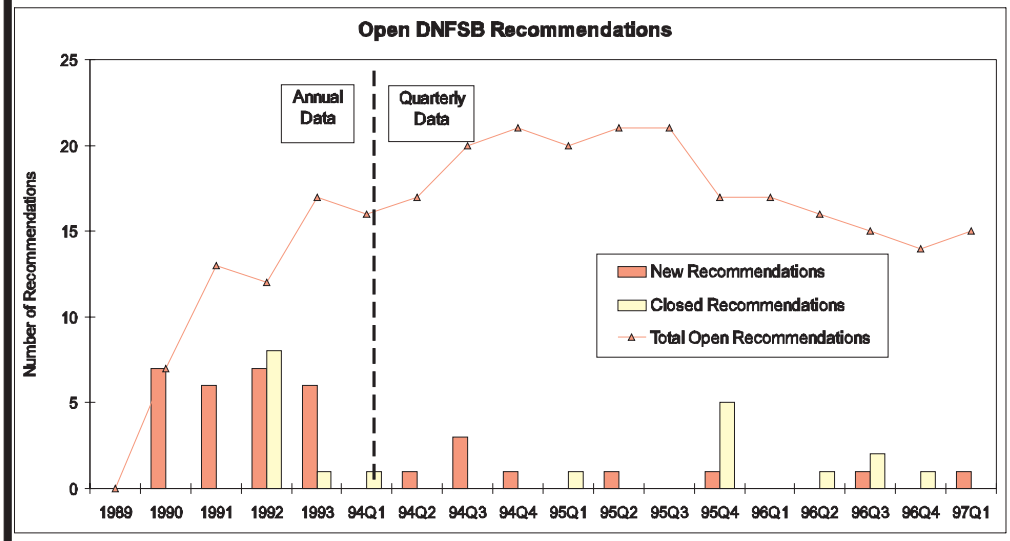
*Indicator*

# 18. Open DNFSB Recommendations

*Definition*

The cumulative number of open Defense Nuclear Facilities Safety Board (DNFSB) recommendations. DNFSB recommendations only apply to DOE defense nuclear facilities and, therefore, are representative only of DOE defense facilities involved in nuclear safety issues.

Each DNFSB recommendation accepted by DOE leads to an implementation plan containing a set of commitments which, when fully implemented, will resolve the safety issues and lead to closure of the recommendation. A commitment is any documented obligation by the Secretary, or designee, that describes products to be delivered on a specified schedule. Commitments resulting from DNFSB recommendations are tracked by the Office of the Departmental Representative to the DNFSB (S-3.1) as completed (fulfilled), not yet due, and overdue.




*Source: Safety Issues Management System (SIMS).*

*Key Observations*

- As of March 1997, there were 15 open DNFSB recommendations representing 619 DOE commitments. 62% of the commitments were considered to be satisfied or fulfilled. Recommendation 97-1 (Safe Storage of Uranium 233) was received from the Board during 97Q1, while no recommendations were removed.

- The Department and the DNFSB agreed that remaining commitments under Recommendation 90-2 (Codes and Standards) were subsumed under implementation of Recommendation 95-2 (Safety Management); the associated 90-2 commitments were closed.

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*Additional Analysis*

- Environmental Management (EM) and Defense Programs (DP) continue to be responsible for implementing most of the recommendations. Recommendation 97-1 (Safe Storage of Uranium 233) does not currently have an approved implementation plan and, therefore, does not represent any commitments. The cumulative subtotals through 97Q1 for the 14 recommendations with approved implementation plans are represented in the table on the following page.

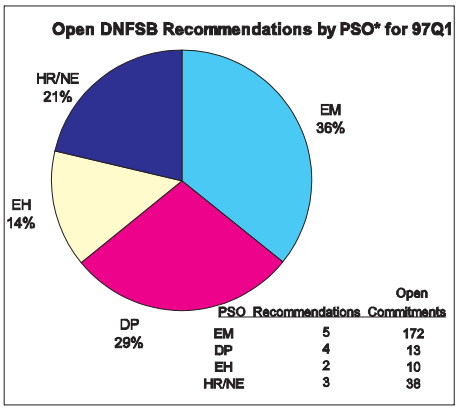
| Office | DNFSB Recommendation | Commitments | Fulfilled | Not Yet Due | Overdue | Open |
|---|---|---|---|---|---|---|
| EM | 5 | 394 | 222 (56%) | 151 (39%) | 21 (5%) | 172 (44%) |
| DP | 4 | 106 | 93 (88%) | 12 (11%) | 1 (1%) | 13 (12%) |
| EH | 2 | 21 | 11 (52%) | 3 (14%) | 7 (34%) | 10 (48%) |
| HR/NE | 3 | 98 | 60 (61%) | 20 (21%) | 18 (18%) | 38 (39%) |
| Total | 14 | 619 | 386 (62%) | 186 (30%) | 47 (8%) | 233 (38%) |

- 2 of the 15 open recommendations have 100% of the associated commitments complete (93-6 and 95-1) and the Department proposed closure of Recommendation 93-6 (Maintaining Access to Nuclear Weapons Expertise) in December 1996.

## Distribution of Open Commitments

- There continues to be an improving trend in the number of open commitments (the sum of overdue commitments and not yet due commitments based on a projected schedule of completion incorporated within the implementation plans). At the end of December 1996, there were 341 open commitments and March 1997 ended with 233 open commitments. As a subset of open commitments, overdue commitments decreased from 123 at the end of December 1996 to 47 at the end of March 1997. The total number of recommendation-related commitments has decreased over the most recent quarter due to close-out of Recommendation 90-2 commitment tracking (Codes and Standards).

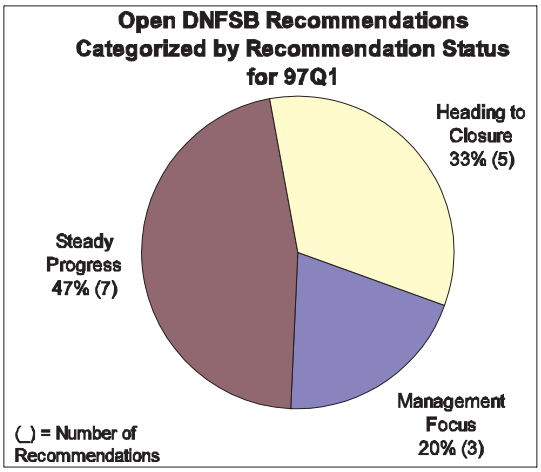
- EM and HR are responsible for 45% and 38% of the overdue commitments, respectively.




## Characterization of Recommendation Status

- The graph shows an evaluation by S-3.1 on the number of open DNFSB recommendations categorized by recommendation status. A status of “Heading to Closure” includes the existence of a clearly defined path to closure, and the expectation that the remaining commitments/actions can be completed within the next year. “Steady Progress” implies the existence of an acceptable implementation plan with most commitments/deliverables generally being completed on schedule. Recommendations classified as “Management Focus” involve difficulties with (or lack of) an implementation plan or a large number (10) of overdue commitments.

- Two recommendations were added to the Management Focus category during 97Q1. These included Recommendation 93-3 (Improving Technical Capability) which was returned to the list due to the large number of overdue commitments and the agreed-upon need to revise the 93-3 implementation plan, and Recommendation 97-1 (Safe Storage of Uranium 233), issued March 1997. Two Recommendations were removed from "Management Focus" this quarter. Recommendation 90-2 was rolled into Recommendation 95-2, while the status of Recommendation 94-5 was upgraded to "Heading to Closure."



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*Indicator*

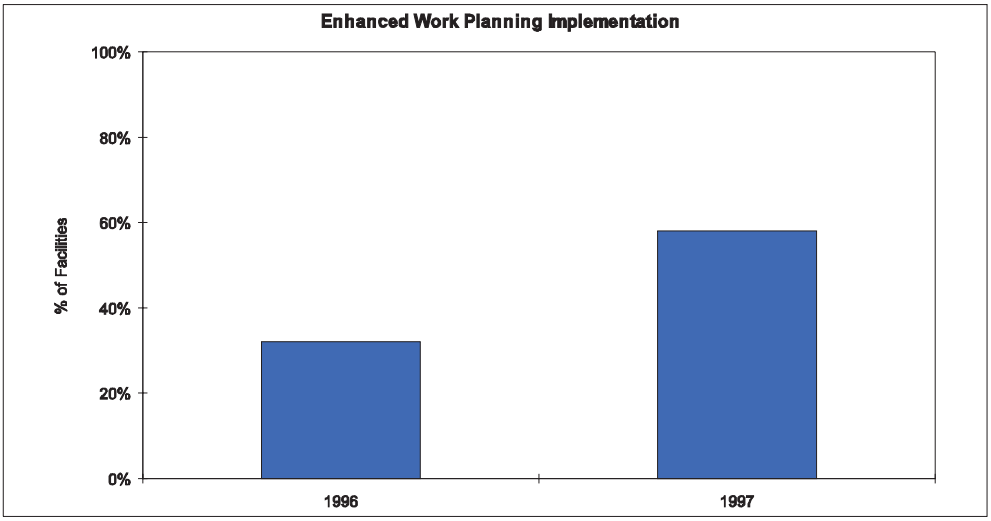
# 19. Enhanced Work Planning Implementation

*Definition*

The number of facilities that have implemented Enhanced Work Planning (EWP) divided by the total number of facilities in DOE.

In developing the performance indicator, a facility was defined as a DOE building as described in the "Site Profiles," a list developed by DOE's EH Office of Oversight. This list was supplemented by additional facilities not covered by Site Profiles such as Ames Lab, Fermi Lab, and the petroleum reserves.

The indicator was originally derived from a review of facility maintenance, as maintenance is common to most buildings/facilities and cross cuts many site activities.




*Source: Office of Field Support, EH-53.*

*Key Observations*

- The number of facilities which participated in EWP increased from 32% in 1996 to 58% in 1997.

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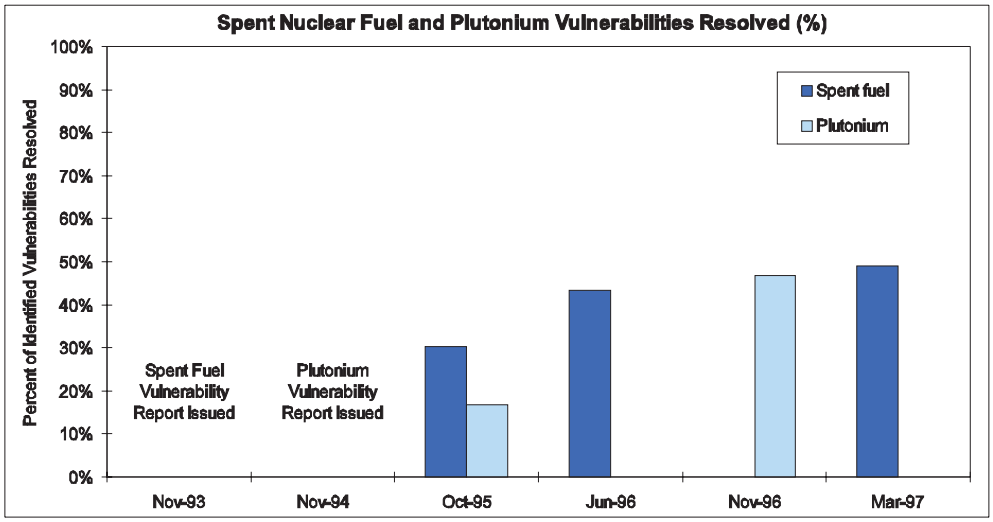
*Indicator*

# 20. Spent Nuclear Fuel and Plutonium Vulnerabilities Resolved

*Definition*

The number of resolved plutonium and spent fuel vulnerabilities divided by the total number of vulnerabilities as defined in *Spent Fuel Working Group Report on Inventory and Storage of the Department's Spent Nuclear Fuel...and Their Environmental, Safety, and Health Vulnerabilities,* Volume 1, November 1993, and *Plutonium Working Group Report on Environmental, Safety, and Health Vulnerabilities*, Volume 1, November 1994 (DOE/EH-0415).

An ES&H vulnerability is defined in the plutonium and spent fuel vulnerability reports as "conditions or weaknesses that could lead to unnecessary or increased radiation exposure of workers, release of radioactive material to the environment or radiation exposure of the public." A resolved vulnerability implies that the cited condition no longer exists, the risk has been minimized to an acceptable level, or the risk has been evaluated at an active facility and judged to be acceptable. Vulnerabilities can be characterized as material/packaging (e.g., storage of unstable and corrosive solutions), facility condition (e.g., facility weaknesses), or institutional vulnerabilities (e.g., loss of experienced personnel). The vulnerabilities were ranked by significance based on the likelihood of an accident and the perceived consequences.




*Source: Draft Plutonium Vulnerability Management Summary Report, March 1997 (EM-66). Report on Status of Corrective Actions to Resolve Spent Nuclear Fuel Vulnerabilities, March 1997 (EM-67).*

*Key Observations*

- There were 299 plutonium vulnerabilities identified at 13 sites, and 106 spent nuclear fuel vulnerabilities identified at 8 sites based on reports issued in 1993 and 1994.
- As of 96Q3, 47% of the identified plutonium vulnerabilities have been resolved.
- As of 97Q1, 49% of the identified spent fuel vulnerabilities have been resolved.

***Additional Analysis***

## Spent Fuel Vulnerability Distribution by Location

- The following table indicates the breakdown of spent nuclear fuel vulnerabilities as of 97Q1 by location and the progress of resolving the identified vulnerabilities.

| Spent Nuclear Fuel Site | Vulnerabilities Identified | Vulnerabilities Resolved | Percent Resolved |
|---|---|---|---|
| Hanford | 36 | 21 | 58% |
| Idaho | 33 | 5 | 15% |
| Savannah River | 21 | 17 | 81% |
| All Others | 16 | 9 | 56% |
| Total | 106 | 52 | 49% |

- The most spent nuclear fuel vulnerabilities (34%) were identified at Hanford, which maintains 80% of the DOE total spent nuclear fuel inventory by weight.

## Plutonium Vulnerability Distribution by Location

- The following table indicates the breakdown of plutonium vulnerabilities as of 96Q3 by location and the progress of resolving the identified vulnerabilities.

| Plutonium Site | Vulnerabilities Identified | Vulnerabilities Resolved | Percent Resolved |
|---|---|---|---|
| Rocky Flats | 87 | 34 | 39% |
| Los Alamos | 60 | 36 | 60% |
| Savannah River | 40 | 13 | 33% |
| Hanford | 34 | 9 | 26% |
| All Others | 78 | 48 | 62% |
| Total | 299 | 140 | 47% |

- The most plutonium vulnerabilities (29%) were identified at Rocky Flats, which maintains 80% of the DOE total plutonium inventory by weight. Of these 87 vulnerabilities, 16 have been closed and an additional 18 have had the risk reduced to an acceptable level.

- Los Alamos had similar success pursuing plutonium vulnerabilities with 14 issues closed and the risk in 22 other issues reduced to an acceptable level.

- 16 of the top 46 highest risk plutonium vulnerabilities, DOE-wide, have been resolved. 10 were completed; the risk for 6 other issues has been reduced or judged acceptable.

*Indicator*

# 21. Plutonium Stabilization

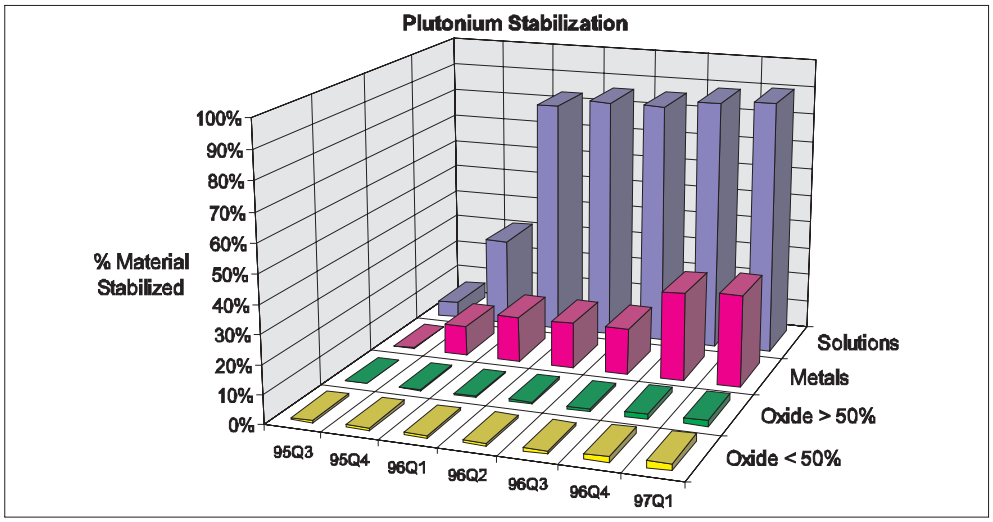
*Definition*

Progress in plutonium (Pu) stabilization as outlined in the DOE implementation plan response to DNFSB Recommendation 94-1. The performance measure is depicted in cumulative percentages of the total inventory (in stabilization units; SU) of plutonium solutions, metals, and oxides that are stabilized.

1 Pu solution SU = 4000 liters

1 metal SU = 90 kg

1 oxide SU = 60 kg




*Source: Nuclear Materials Stabilization Task Group Quarterly Report. BNL Data Base on Plutonium Stabilization.*

*Key Observations*

- Only modest progress was made in stabilizing plutonium during 96Q4 and 97Q1. During this time period, 5,629 liters of the remaining 57,950 liters of plutonium solution were stabilized. Of the remaining 17,724 kgs of plutonium metal and oxides to be stabilized, 302 kgs were stabilized during 96Q4 and 97Q1.

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*Additional Analysis*

- Only Rocky Flats and Los Alamos National Laboratory reported progress in stabilizing plutonium inventories during 96Q4 and 97Q1. Specifically, Rocky Flats was responsible for all the plutonium solution and oxide stabilized while Los Alamos National Laboratory reported all the plutonium metal stabilized.

- It is recognized that there is not a one-to-one correlation between the quantity of plutonium stabilized and the associated reduction in risk to DOE workers, the public, or the environment. Factors such as material form and packaging play an important role in accurately measuring risk reduction. Additional efforts are needed to fully evaluate risk reduction related to plutonium stabilization activities.

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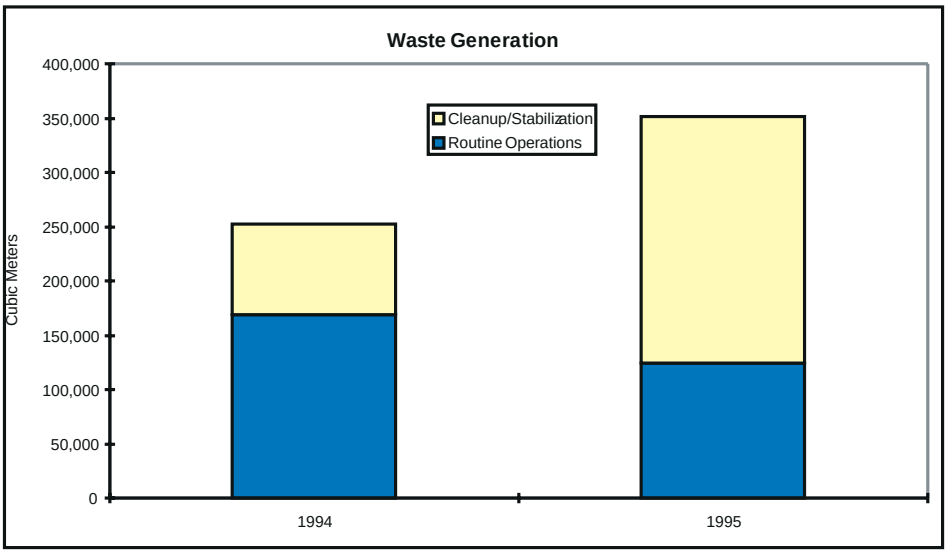
*Indicator*

# 22. Waste Generation

*Definition*

Total amount of waste generated, in cubic meters, for all DOE Sites. Waste types generated include High Level Radioactive, Transuranic, Low Level Radioactive, Low Level Mixed, Hazardous, and Sanitary. These waste types are generated during routine operations or cleanup/stabilization activities.

- Routine operations waste consists of normal operation waste produced by any type of production operation; analytical and/or research and development laboratory operations, treatment, storage and disposal operations; "work for others"; or any other periodic or recurring work that is considered ongoing in nature.
- Cleanup/stabilization waste, including primary and secondary waste, is generated by the environmental restoration of contaminated media (soil, groundwater, surface water, sediments, etc.); stabilization of nuclear and nonnuclear (chemical) materials; and deactivation and decommissioning of facilities.




*Key Observations*

- The overall amount of waste generated increased from 252,515 cubic meters to 351,883 cubic meters from 1994 to 1995. However, during this same time period, the amount of waste generated during routine operations (excluding sanitary) decreased 37% (from 49,781 cubic meters to 31,433 cubic meters), while the amount of waste generated during cleanup/stabilization operations (excluding sanitary) increased 66% (from 73,741 cubic meters to 124,519 cubic meters).

- The following tables subcategorize waste generation based on production source: routine or cleanup/stabilization activities.

### Waste Generated During Routine Activities (cubic meters)

| Waste Type | 1994 | 1995 |
|---|---|---|
| High Level Radioactive | 2,071 | 2,496 |
| Transuranic | 568 | 336 |
| Low Level Radioactive | 29,918 | 21,281 |
| Low Level Mixed | 2,837 | 1,868 |
| Hazardous | 14,387 | 5,452 |
| Sanitary | 119,561 | 92,544 |

### Waste Generated During Cleanup/Stabilization Activities (cubic meters)

| Waste Type | 1994 | 1995 |
|---|---|---|
| Transuranic | 192 | 156 |
| Low Level Radioactive | 44,279 | 92,968 |
| Low Level Mixed | 13,040 | 5,563 |
| Hazardous | 16,230 | 25,832 |
| Sanitary | 9,432 | 103,387 |

- From 1994 to 1995, waste generated during routine activities decreased by 29% for Low Level Radioactive Waste, 34% for Low Level Mixed Waste, 41% for Transuranic Waste, and 62% for Hazardous Waste.

- From 1994 to 1995, waste generated during cleanup/stabilization activities increased 110% for Low Level Radioactive Waste. 89% of the increase was due to the Fernald Environmental Management Project generating an additional 41,687 cubic meters during remediation activities.

- From 1994 to 1995, waste generated during cleanup/stabilization activities increased 62% for Hazardous Waste. The Argonne National Laboratory, Bonneville Power Administration, and the Pantex Plant accounted for 63% of the Hazardous Waste produced during cleanup/stabilization activities. One Argonne National Laboratory East cleanup effort generated 12,166 cubic meters of hazardous waste, 47% of the hazardous waste generated during cleanup/stabilization activities.

- Sanitary Waste accounted for 51% of all waste generated in 1994 and 56% in 1995. In 1995, Sanitary Waste generated during cleanup/stabilization activities accounted for 53% of the Sanitary Waste generated and 29% of all waste generated in the DOE complex.

***Additional Analysis***

*Indicator*

# 23. HEU Vulnerabilities Resolved

*Definition*

The percentage of vulnerabilities identified in the *Highly Enriched Uranium Working Group Report on Environmental, Safety and Health Vulnerabilities Associated with the Department's Storage of Highly Enriched Uranium* (DOE/EH-0525) that have been resolved.

*Key Observations*

This indicator will be used to measure the progress in resolving the total of 155 ES&H vulnerabilities found in the assessment, and also specific subsets of these vulnerabilities: 1) the facility and material condition vulnerabilities ranked by the HEU Working Group as being of highest significance, 2) vulnerabilities at specific sites, and 3) vulnerabilities involving U-233.

A significant fraction of the HEU Working Group's assessment involved U-233, stemming from this isotope's particular radiological properties (and those of U-232 co-produced with U-233). The HEU Working Group concluded that a special management plan is needed for safe interim storage of U-233 materials. Thus, U-233 vulnerabilities will be tracked as a separate group, even though this will involve "double counting" of some vulnerabilities ranked as having the highest significance.

An ES&H vulnerability is defined in the HEU Working Group Report as "conditions or weaknesses that could result in the exposure of workers or the public to radiation, or in releases of radioactive materials to the environment." Led by the Office of Defense Programs (DP), DOE has developed the *HEU Vulnerability Management Plan* (currently in draft) that outlines a process for corrective actions and resolution of the HEU vulnerabilities. DP will track the resolution of the HEU vulnerabilities and report these either by a separate quarterly status report, or by information included in status reports that combine HEU vulnerability resolution with those for plutonium and/or spent fuel vulnerabilities.

The following table summarizes the Department-wide status of HEU vulnerability resolution:

| HEU Vulnerability Set | Vulnerabilities Identified | Vulnerabilities Resolved* | P.I. = % Resolved* |
|---|---|---|---|
| Total, DOE-Wide | 155 | | |
| Highest Significance | 21 | | |
| U-233 Vulnerabilities | 13 | | |

* HEU Vulnerability Management Plan currently in draft.

***Additional Analysis***

The following table summarizes vulnerabilities on a site basis. Note that the Oak Ridge Y-12 Plant stores a far greater amount of HEU (greater than 189 metric tons) than any other site. Note also that ORNL and INEEL have the largest quantities of U-233 (424 and 40 kilograms, respectively).

| HEU Site | Vulnerabilities Identified | Vulnerabilities Resolved* | P.I. = Resolved* |
|---|---|---|---|
| Oak Ridge Y-12 Plant | 49 | | |
| Rocky Flats Env. Tech. Site | 28 | | |
| Los Alamos National Lab | 19 | | |
| Portsmouth Gaseous Dif. Plant | 16 | | |
| Idaho Nat. Engineering & Environmental Lab | 10 | | |
| Savannah River Site | 9 | | |
| Oak Ridge K-25 Site | 9 | | |
| Oak Ridge National Lab | 6 | | |
| Pantex Plant, | 5 | | |
| Sandia National Laboratories | 1 | | |
| Argonne National Lab-West | 1 | | |
| Lawrence Livermore Nat. Lab | 1 | | |
| New Brunswick Laboratory | 1 | | |

As of this report, the HEU Vulnerability Management Plan was still in draft. When finalized, this plan will set dates for resolution of the 21 HEU vulnerabilities designated by the HEU Working Group as being of highest significance. Thus, tracking of the PIs for these 21 vulnerabilities can be shown against scheduled completion dates after the Management Plan is issued.

The resolution of the other 134 HEU vulnerabilities identified in the HEU Vulnerability Assessment will depend on site-specific plans. Many of the plans may become part of existing plans for DNFSB 94-1. Because of the need to work with separate field offices, scheduling and tracking of PIs concerning the other 134 vulnerabilities will take more effort and time to perform than those explicitly covered in the HEU Management Plan.

On March 3, 1997, the DNFSB issued Recommendation 97-1 which concerns the safety of U-233. Many of the Board's recommendations reflect findings and conclusions made in the HEU Vulnerability Assessment. The Department's Implementation Plan for Recommendation 97-1 was accepted by the Board on October 21; Tracking of Vulnerabilities Associated with U-235 will be based on this Implementation Plan.

## The Secretary's Commitments to the President in ES&H and EQ

Environment, Safety and Health (ES&H) and Environmental Quality (EQ) commitments as part of the Secretary of Energy's Performance Agreement with the President for Fiscal Year 1997 are currently under development. This section will include a summary of these commitments and their status in future ES&H Performance Indicator Reports.

More information related to the status of these commitments can be obtained from DOE's Office of Policy or via the World Wide Web at:

http://www.doe.gov/policy/library/sagree97.html

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## Relationship to DOE Strategic Plan Goals

| DOE STRATEGIC PLAN (April 1994) | PERFORMANCE INDICATORS |
|---|---|
| ***Eliminate Hazards and Releases*** **Environment, Safety & Health Goal 1** *Empower workers and take other necessary actions to prevent all serious injuries and all fatalities, and to eliminate all worker exposures and environmental releases in excess of established limits. By eliminating these exposures and releases, reduce the incidence of illness among workers and the public, and prevent damage to the environment.* | 1-2. OSH (Lost Workday Case Rate, Cost Index)<br>3. Electrical Safety<br>4. Industrial Operations Safety<br>6. Reportable Occurrences of Releases to the Environment<br>8. Environmental Permit Exceedances<br>9. Price-Anderson Amendments Act Enforcement<br>10. Radiation Dose to the Public<br>11. Worker Radiation Dose<br>12. Radiological Events<br>13. Near Misses and Safety Concerns<br>14. Inadequate Procedures/Procedures Not Followed<br>15. Safety System Actuations |
| ***Performance Requirements*** **Environment, Safety & Health Goal 2** *Ensure there are specific environmental, safety, and health performance requirements for DOE activities which are the basis for measuring progress toward continuous improvement.* | 1-2. OSH (Lost Workday Case Rate, Cost Index)<br>11. Worker Radiation Dose<br>12. Radiological Events |
| ***Establish Priorities*** **Environment, Safety & Health Goal 3** *Establish clear environmental, safety, and health priorities and manage all activities in proactive ways that effectively and significantly increase protection to the environment and to the public and worker safety and health.* | 20. Spent Nuclear Fuel and Plutonium Vulnerabilities Resolved<br>21. Plutonium Stabilization<br>23. HEU Vulnerabilities |
| ***Demonstrate Performance*** **Environment, Safety & Health Goal 4** *Demonstrate respectable performance related to environmental protection and worker/public safety and health.* | All |

(Numbers refer to corresponding Sections in this report.)

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# Summary of Process

## B1. Overview



One of the critical success factors identified in the Department of Energy (DOE) Strategic Plan for environment, safety and health is "ensuring the safety and health of workers and the public and the protection and restoration of the environment." This report describes a new approach for measuring the performance of DOE operations in these areas and thereby supporting management decisions aimed at "ensuring the safety." The general concept is to focus on key factors with the most impact on worker and facility safety and the environment.

Data collection was limited to available data (e.g., ORPS, CAIRS, Site Environmental Reports). The process was non-intrusive and did not expend site resources. As such, the performance indicator components may not sufficiently measure all facets of environment, safety and health. Experience from this report, along with customer feedback from the attached survey form, will be evaluated. Subsequent reports may evolve to include incorporating the components into an index to represent the combined effect that the activities have on the envelope of safety that protects the worker and the environment as experience is gained and data sources improve.

This report was reviewed by a multi-disciplinary team with expertise in nuclear and facility safety, environment, worker safety and health, health studies, and planning/administration. The team is identified in table at the end of this appendix.

## B1.1 Initial Performance Measures

The performance measures included in this report are identified in the following table. Selection of the indicators involved both evaluation of the overall safety significance as well as tests of availability. A process was established where all potential indicators were evaluated with respect to significance to the ultimate goal of measuring performance in environment, safety and health. With respect to availability, a decision was made to select indicators from existing data streams to avoid, for now, levying a burden on field activities for additional data. Primarily, indicators are derived from data within four data systems and one annual report:

- *Occurrence Reporting and Processing System (ORPS)* - a system originally designed for notification of nuclear as well as non-nuclear occurrences in the field. For all indicators based on occurrence reports, data prior to 93Q1 has been removed from the graphs and analysis.
- *Computerized Accident/Incident Reporting System (CAIRS)* - a system for collecting data associated with occupational injury and illness events and statistics.
- *Radiation Exposure Monitoring System (REMS)* - a system for collecting data on individual radiation doses received by DOE complex workers.
- *Environmental Compliance Database* - a system maintained by the Office of Environmental Policy and Assistance.
- *Annual Site Environmental Reports.*

There are, of course, limitations resulting from using the data for other than the purpose for which it was collected. Further, the availability of data should not be confused with relevance to measuring performance. Indicators should be selected based on their impact on the operations being examined, not solely because the data exist. Although some of the selected indicators may be of interest to other audiences, it is likely that other valid indicators exist that should be analyzed and trended to provide the appropriate perspective (e.g., facility, contractor, program management) on performance.

| PI Component | Data Source |
|---|---|
| **I. Accidents/Events** | |
| 1 Lost Workday Case Rate | Computerized Accident/Incident Reporting System, EH-51 |
| 2 Occupational Safety & Health Cost Index | Computerized Accident/Incident Reporting System, EH-51 |
| 3 Electrical Safety | Review of Occurrence Reports, EH-33<br>Defense Programs Review of Occurrence Reports |
| 4 Industrial Operations Safety | Review of Occurrence Reports, EH-33<br>Defense Programs Review of Occurrence Reports |
| 5 Chemical Hazard Events | Quarterly Review of Chemical Safety Concerns/Occurrence Reporting and Processing System, EH-52/EH-53/BNL |
| 6 Reportable Occurrences of Releases to the Environment | Review of Occurrence Reports, EH-33 |
| 7 Cited Environmental Violations | Environmental Compliance Tracking Database, EH-41 |
| 8 Environmental Permit Exceedances | Annual Site Environmental Reports, EH-41 |
| 9 Price-Anderson Amendments Act Enforcement | Office of Enforcement and Investigation database |
| 10 Radiation Dose to the Public | Annual Reports to Environmental Protection Agency (EPA) by Each Site, EH-41 |
| 11 Worker Radiation Dose | Radiation Exposure Monitoring System (REMS), EH-52 |
| 12 Radiological Events | Review of Occurrence Reports, EH-33 |
| **II. Precursors** | |
| 13 Near Misses & Safety Concerns | Review of Occurrence Reports, EH-33 |
| 14 Inadequate Procedures/ Procedures Not Followed | Review of Occurrence Reports, EH-33 |
| 15 Safety System Actuations | Review of Occurrence Reports, EH-33 |
| 16 Safety Equipment Degradation | Review of Occurrence Reports, EH-33 |
| **III. ES&H Management** | |
| 17 Environmental Compliance Milestones Met | EM Progress Tracking System (PTS), EH-41 |
| 18 Open DNFSB Recommendations | Safety Issues Management System (SIMS), S-3.1 |
| 19 Enhanced Work Planning Implementation | Office of Field Support, EH-53 |
| **IV. Hazards** | |
| 20 Spent Nuclear Fuel and Plutonium Vulnerabilities Resolved | Plutonium Vulnerability Management Summary Report, EM-60; Reports on Status of Corrective Actions to Resolve Spent Nuclear Fuel Vulnerabilities, EM-37 |
| 21 Plutonium Stabilization | Nuclear Materials Stabilization Task Group Quarterly Report, Data tracked by Brookhaven National Laboratory, EM-66 |
| 22 Waste Generation | Waste Minimization Reporting System, Office of Environmental Management |
| 23 HEU Vulnerabilities | Highly Enriched Uranium Working Group Report on Environmental, Safety & Health Vulnerabilities Associated with the Department's Storage of Highly Enriched Uranium, EH-32 |

# B2. Data Analysis

## B2.1 Analyses Performed

The data analysis results are summarized in the DOE Performance Indicator Report. They are intended to identify areas which should be further investigated (to identify areas that may require intervention as well as good practices to share across DOE); they do not provide absolute answers in themselves. Data analyses include:

- looking for statistically significant trends over time,
- comparison to historical averages or benchmarks (e.g., Bureau of Labor Statistics for similar industries),
- normalization of events to opportunities (e.g., construction related events divided by construction hours worked or construction dollars spent),
- examination for statistically significant trends in types of operations, severity or type of events, and causes.

Typically, the historical baseline is established using existing data excluding the most recent quarter. The two most recent quarters are excluded for data originating from CAIRS to account for the time lag in data reporting.

Where possible, data were analyzed by quarter. In some cases, data were also viewed monthly to reveal any interesting seasonal effects not evident in the quarterly data grouping. Where appropriate, sites were contacted to provide perspective for unusual data values or trends. Data sources for several of these measures are annual; the need for more frequent data must be evaluated for future reports.

The data can also be used to perform other special analyses and reports (such as trends in causes and types of events). These analyses and reports could support special needs, such as oversight preparation and programmatic reviews.

The same approach can be used to perform more detailed functional or programmatic analyses by identifying subsets (peer groups) of DOE facilities for further examination. Examples of peer groups might include: reactors, accelerators, major clean-up sites, waste storage areas, defense chemical facilities, fossil energy sites, laboratories and spent fuel storage facilities.

## B2.2 Determining Statistical Significance of Trends

The Multinomial Likelihood Ratio Test (MLRT) is used to determine statistical significance of trends. MLRT performs separate tests for increasing and decreasing trends in a sequence of 2 to 30 counts of an event. The tests are based on a multinomial distribution assumption for the counts. Therefore, the sequence must be counting discrete events that are independent over time. An event is a physically indivisible quantity, such as an incident. These tests are also useful for performing trend analysis of rare events.

MLRT computes a ratio of constant trend likelihood to increasing (or decreasing) trend likelihood from the observed sequence of counts. Therefore, small values of the ratio favor an increasing (or decreasing) trends. Consider the following question: “If the data are generated by a constant trend multinomial model, what is the probability of observing

a smaller ratio than that computed from the observed sequence?" This probability is called the significance level of the test and is interpreted as follows:

| Significance Level | Conclusion |
|---|---|
| > 0.1 to 1.0 | no departures from constant trend detected |
| > 0.05 to 0.1 | possible increasing (or decreasing) trend |
| > 0.01 to 0.05 | probable increasing (or decreasing) trend |
| > 0.001 to 0.01 | very probable increasing (or decreasing) trend |
| 0 to 0.001 | highly probable increasing (or decreasing) trend |

The significance level is analogous to precision of measurement. As always, the importance of any precisely measured (i.e., statistically significant) quantity depends on the subject matter and context.

## B3. Future Plans

This report is considered a "work in progress". Since the last report, 3 indicators have been added and 3 indicators have been deleted. Future activities are focused on obtaining feedback on the approach and improving the effectiveness of the product, including:

- Developing, in partnership with the field organizations, performance indicators that provide a measure of how well DOE is doing in (a) reducing hazards or vulnerabilities and (b) safety management including training, management involvement, and worker involvement. These new measures, combined with measures currently available, will more ably answer the critical questions of "what is DOE's actual and potential impact on people and the environment" and "is DOE getting safer."
- Providing more normalized or risk-based data that lends itself better to analysis and comparison.
- Establishment of Corporate goals for most indicators and comparison to average and best-in-class companies.
- Internet web-based tools to provide up-to-date data and charts of most performance indicators.

Future reports will be refined as data are gathered and customer input is received. Over time, new knowledge and changing missions will be reflected in the process.

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# Glossary

***Baselines***

***Baselines*** provide an historical reference point used to show how the current period compares to past experience. Generally, historical baselines are established using existing data excluding the most recent reporting period. For the data which originates from CAIRS, the two most recent quarters are excluded to account for the lag in data reporting. Baselines established for data originating from occurrence reports are reevaluated each time the governing reporting order changes. In addition, the graphs show the historical baseline ±1 standard deviation to give the reader a feel for the variation associated with the data. For Performance Indicators where there are insufficient data to calculate a meaningful baseline, no baseline is shown on the graph.

***Multinomial Likelihood Ratio Test (MLRT)***

**MLRT** is used to determine statistical significance of trends. MLRT performs separate tests for increasing and decreasing trends in a sequence of 2 to 30 counts of an event. The tests are based on a multinomial distribution assumption for the counts. Therefore, the sequence must be counting discrete events that are independent over time. An event is a physically indivisible quantity, such as an incident. These tests are also useful for performing trend analysis of rare events. MLRT computes a ratio of constant trend likelihood to increasing (or decreasing) trend likelihood from the observed sequence of counts. Therefore, small values of the ratio favor an increasing (or decreasing) trend. Consider the following question: “If the data are generated by a constant trend multinomial model, what is the probability of observing a smaller ratio than that computed from the observed sequence?” This probability is called the significance level of the test and is interpreted as follows:

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| > 0.001 to 0.01 | very probable increasing (or decreasing) trend |
| 0 to 0.001 | highly probable increasing (or decreasing) trend |

The significance level is analogous to precision of measurement. As always, the importance of any precisely measured (i.e., statistically significant) quantity depends on the subject matter and context.

***Total Effective Dose Equivalent (TEDE)***

**TEDE** equals the sum of the External Dose Contribution and the Internal Dose Contribution. Prior to 1993, the method for calculating the internal dose contribution changed from an annual internal dose to a dose committed over 50 years. Although one may expect this change would result in higher reported doses, the elimination of the “legacy” doses from previous years’ exposures resulted in lower reported doses.

**Price-Anderson Amendments Act (PAAA)**

**Price-Anderson Amendments Act (PAAA).** The 1988 Price-Anderson Amendments Act extended indemnification to DOE operating contractors for consequences of a nuclear incident. At the same time, Congress required DOE to begin undertaking enforcement actions against those contractors who violate nuclear safety rules. The regulatory basis for the enforcement program is published in 10CFR820, Procedural Rules for DOE Nuclear Activities. Enforcement actions may include the issuance of Notices of Violations and, where appropriate, civil monetary penalties of up to $100,000

per violation per day. The mechanism allows DOE to penalize a contractor for unsafe actions or conditions while providing positive incentives for contractors to strive for an enhanced nuclear safety culture through attention to compliance to standards and requirements, self-identification of problems, reporting noncompliances to DOE and initiating timely and effective corrective actions.

***Enhanced Work Planning (EWP)***

**Enhanced Work Planning (EWP)** is a process that evaluates and improves the program by which work is identified, planned, and executed in an efficient manner. The key elements of EWP are: a graded approach to work management, diverse teams, institutionalized communication and worker involvement from the beginning.

The following terms are related to occurrence reporting, as required by DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*.

***Occurrence Categories (types of occurrences)***

**Occurrence categories** are arranged into 10 generic groups related to DOE operations and include the following:

- 1. Facility Condition
- 2. Environmental
- 3. Personnel Safety
- 4. Personnel Radiation Protection
- 5. Safeguards and Security
- 6. Transportation
- 7. Value Basis Reporting
- 8. Facility Status
- 9. Nuclear Explosive Safety
- 10. Cross-Category Items

***Severity of Occurrence***

**Severity of occurrence** indicates the degree of significance associated with the different types of occurrences.

Unusual Occurrence: A non-emergency occurrence that exceeds the Off-Normal Occurrence threshold criteria; is related to safety, environment, health, security, or operations; and requires immediate notification to DOE.

Off-Normal Occurrence: Abnormal or unplanned event or condition that adversely affects, potentially affects, or is indicative of degradation in the safety, safeguards and security, environmental or health protection, performance, or operation of a facility.

***Facility Function***

**Facility function** identifies the type of facility or the activity/function performed by the facility. Possible facility functions are listed below.

- Plutonium Processing and Handling
- Special Nuclear Materials Storage
- Explosive
- Uranium Enrichment
- Uranium Conversion/Processing and Handling
- Irradiated Fissile Material Storage

- Reprocessing
- Nuclear Waste Operations
- Tritium Activities
- Fusion Activities
- Environmental Restoration Operations
- Category “A” Reactors
- Category “B” Reactors
- Solar Activities
- Fossil and Petroleum Reserves
- Accelerators
- Balance-of-Plant (e.g., offices, machine shops, site/outside utilities, safeguards/security, and transportation)

***Causes of Occurrences***

**Causes of occurrences** are determined by performing event investigations and may be identified as direct, contributing, or root causes.

- Direct Cause: The cause that directly resulted in the occurrence.
- Contributing Causes: The cause(s) that contributed to the occurrence but, that by itself, would not have caused the occurrence.
- Root Cause: The cause that, if corrected, would prevent recurrence of this and similar occurrences.

Cause categories are selected from the following:

1. Equipment/material problem: An event or condition resulting from the failure, malfunction, or deterioration of equipment or parts, including instruments or material.
2. Procedure problem: An event or condition that can be traced to the lack of a procedure, an error in a procedure, or procedural deficiency or inadequacy.
3. Personnel error: An event or condition due to an error, mistake or oversight. Personnel errors include inattention to details of the task, procedures not used or used incorrectly, communication problems, and other human errors.
4. Design problem: An event or condition that can be traced to a defect in design or other factors related to configuration, engineering, layout, tolerances, calculations, etc.
5. Training deficiency: An event or condition that can be traced to a lack of training or insufficient training to enable a person to perform a desired task adequately.
6. Management problem: An event or condition that can be directly traced to managerial actions or methods. Management problems include inadequate administrative control, work organization/planning deficiency, inadequate supervision, improper resource allocation, policies not adequately defined, disseminated or enforced, and other management problems.
7. External phenomenon: An event or condition caused by factors that are not under the control of the reporting organization or the suppliers of the failed equipment or service.
8. Radiation/hazardous material problem: An event related to radiological or hazardous material contamination that cannot be attributed to any other causes.

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# Product Improvement Survey Form

**Purpose of the Product** - The Office of Operating Experience Analysis and Feedback, EH-33, is developing a set of indicators for measuring the performance of DOE operations in the areas of Worker Safety and Health and the Environment. The indicators are intended to measure the Department's success in its strategic goal to manage and improve its environmental, safety, and health (ES&H) performance. The major customers for these indicators are expected to be the senior leadership of DOE.

In order to assess the effectiveness of this new performance indicator report, we would appreciate your assistance by providing responses to the following (check one):

| | | | |
|---|---|---|---|
| 1. | Do you use indicators to measure performance? | ❑ Yes | ❑ No |
| 2. | Do you feel that improved methods for measuring performance are needed? | ❑ Yes | ❑ No |
| 3. | Would you make management decisions based on this kind of information? | ❑ Yes | ❑ No |
| 4. | Does DOE-wide ES&H performance matter to you? | ❑ Yes | ❑ No |

5. What are your information needs with regard to measuring Department-wide ES&H success:

- ❑ Quick pulse of the Department ES&H success
- ❑ Light detail concerning the Department ES&H success
- ❑ Moderate detail concerning the Department ES&H success
- ❑ I have no need for this information on a regular basis

**Report Evaluation** - From your review of this report, ***and in consideration of the purpose stated above***, mark the number that most closely corresponds to your reaction to the following statements

| | | ***Strongly Agree*** | | | ***Neutral*** | | | ***Strongly Disagree*** |
|---|---|---|---|---|---|---|---|---|
| 6. | The performance indicators are relevant to the measurement of overall DOE ES&H performance. | ⑦ | ⑥ | ⑤ | ④ | ③ | ② | ① |
| 7. | The report layout (text and graphics) is logical and easy to understand. | ⑦ | ⑥ | ⑤ | ④ | ③ | ② | ① |
| 8. | The data presented in this report are consistent with my impressions of DOE's ES&H performance. | ⑦ | ⑥ | ⑤ | ④ | ③ | ② | ① |
| 9. | The performance indicators provide a "balanced" view (e.g., successes and problems) of DOE's ES&H performance. | ⑦ | ⑥ | ⑤ | ④ | ③ | ② | ① |
| 10. | This report concept can help measure DOE's success in managing and improving its ES&H performance. | ⑦ | ⑥ | ⑤ | ④ | ③ | ② | ① |
| 11. | This report concept can be useful in communicating information on DOE's ES&H performance to external customers. | ⑦ | ⑥ | ⑤ | ④ | ③ | ② | ① |

| | | | |
|---|---|---|---|
| 12. | Would you be willing to expend time/travel funds to participate in product improvement sessions? | ❑ Yes | ❑ No |
| 13. | Based upon your stated needs, does this report meet your expectations? | ❑ Yes | ❑ No |

Mail or FAX to:

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U.S. Department of Energy
Washington, DC 20585

DOE Operating Experience Analysis
*Safety Management Through Analysis*

FAX number: (301) 903-2329

Page 1 of _____

From:

Name _____

Organization _____

Phone _____

**Comments**: What additional parameter(s) should be monitored and where could the data be obtained? Consider changes required to make this report more useful for your needs and any general observations based on your review. Use additional pages as necessary.